Full wwPDB X-ray Structure Validation Report (i)

Jul 31, 2016 – 07:06 AM EDT

PDB ID	:	5K7J
Title	:	Structure of designed zinc binding protein ZE2 bound to Zn2+
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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
http://wwpdb.org/validation/2016/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:

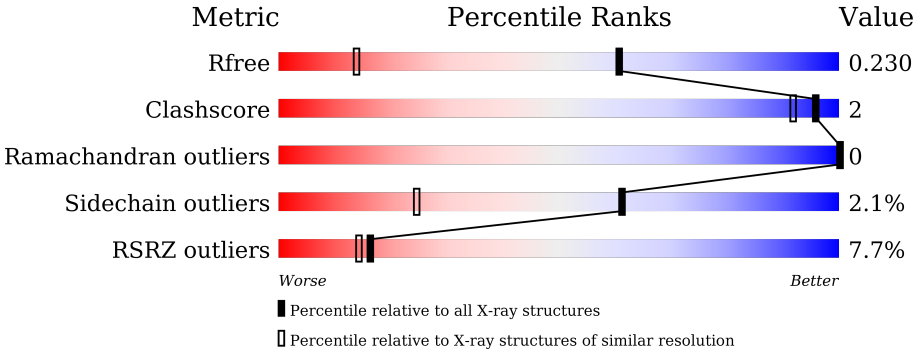
MolProbity	:	4.02b-467
Mogul	:	unknown
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20027939
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20027939

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 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}	91344	1199 (1.40-1.40)
Clashscore	102246	1295 (1.40-1.40)
Ramachandran outliers	100387	1259 (1.40-1.40)
Sidechain outliers	100360	1258 (1.40-1.40)
RSRZ outliers	91569	1198 (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 on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. 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	249	6% 87% 8% • •
1	B	249	8% 88% 9% •

2 Entry composition (i)

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
			Total	C	N	O	S			
1	A	240	1956	1248	342	360	6	0	7	0
1	B	243	1956	1248	340	362	6	0	2	0

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 (three-letter code: ZN) (formula: Zn).

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

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

- Molecule 3 is water.

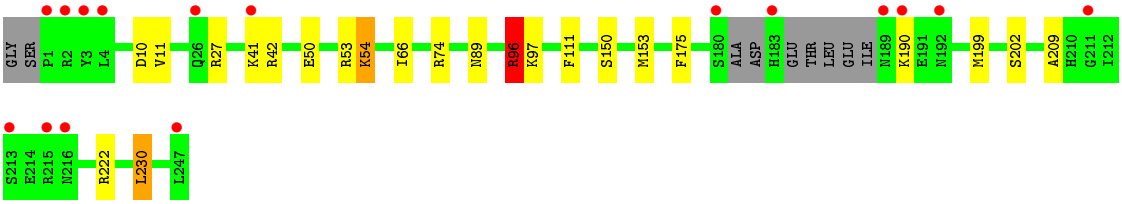
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	63	63	63	0	0
			Total	O		
3	B	68	68	68	0	0

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 errors 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.

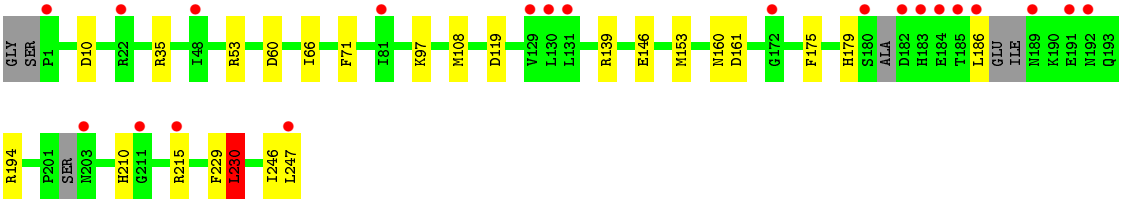
- Molecule 1: Indole-3-glycerol phosphate synthase

Chain A:



- Molecule 1: Indole-3-glycerol phosphate synthase

Chain B:



4 Data and refinement statistics (i)

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) 94.3 (28.62-1.39)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.45 (at 1.39Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.196 , 0.230 0.196 , 0.230	Depositor DCC
R_{free} test set	4576 reflections (5.30%)	DCC
Wilson B-factor (Å^2)	15.6	Xtriage
Anisotropy	0.033	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 39.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	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.*

[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 (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	1.21	3/2002 (0.1%)	1.32	17/2689 (0.6%)
1	B	1.26	3/1989 (0.2%)	1.40	15/2671 (0.6%)
All	All	1.23	6/3991 (0.2%)	1.36	32/5360 (0.6%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	146	GLU	CD-OE1	7.86	1.34	1.25
1	B	146	GLU	CD-OE2	6.66	1.32	1.25
1	B	146	GLU	CG-CD	5.92	1.60	1.51
1	A	50	GLU	CD-OE1	5.40	1.31	1.25
1	A	202	SER	CA-CB	5.25	1.60	1.52
1	A	27	ARG	CZ-NH1	5.17	1.39	1.33

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	53	ARG	NE-CZ-NH2	19.42	130.01	120.30
1	B	53	ARG	NE-CZ-NH1	-14.43	113.08	120.30
1	B	153	MET	CG-SD-CE	-14.34	77.26	100.20
1	A	153	MET	CG-SD-CE	-12.93	79.52	100.20
1	B	230	LEU	CB-CG-CD1	11.29	130.19	111.00
1	A	54	LYS	CD-CE-NZ	10.05	134.81	111.70
1	A	27	ARG	NE-CZ-NH2	-9.40	115.60	120.30
1	A	96	ARG	NE-CZ-NH1	9.21	124.90	120.30
1	B	35	ARG	NE-CZ-NH2	8.65	124.63	120.30
1	A	10	ASP	CB-CG-OD1	7.44	125.00	118.30
1	B	175	PHE	CB-CG-CD2	-7.39	115.63	120.80
1	A	175	PHE	CB-CG-CD1	7.32	125.92	120.80
1	A	74	ARG	NE-CZ-NH1	6.78	123.69	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	229	PHE	CB-CG-CD2	-6.46	116.27	120.80
1	A	27	ARG	NE-CZ-NH1	6.11	123.35	120.30
1	A	53	ARG	NE-CZ-NH1	6.03	123.32	120.30
1	B	161	ASP	CB-CG-OD1	5.98	123.69	118.30
1	B	215	ARG	NE-CZ-NH1	5.82	123.21	120.30
1	A	96	ARG	CD-NE-CZ	5.55	131.37	123.60
1	A	230	LEU	CB-CG-CD1	-5.53	101.60	111.00
1	A	10	ASP	CB-CG-OD2	-5.50	113.35	118.30
1	A	96	ARG	NE-CZ-NH2	-5.49	117.55	120.30
1	B	119	ASP	CB-CG-OD2	-5.44	113.40	118.30
1	B	215	ARG	NE-CZ-NH2	-5.42	117.59	120.30
1	A	175	PHE	CB-CG-CD2	-5.39	117.03	120.80
1	B	10	ASP	CB-CG-OD1	5.36	123.12	118.30
1	B	179	HIS	N-CA-CB	-5.32	101.03	110.60
1	A	199	MET	CG-SD-CE	5.28	108.64	100.20
1	A	222	ARG	NE-CZ-NH1	5.16	122.88	120.30
1	B	53	ARG	CD-NE-CZ	5.14	130.80	123.60
1	B	71	PHE	CB-CG-CD2	-5.08	117.24	120.80
1	A	42	ARG	NE-CZ-NH2	5.06	122.83	120.30

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	1956	0	2032	8	0
1	B	1956	0	2019	5	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	12	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 (12) 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:HG3	1:A:96:ARG:HH11	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:A:150:SER:HA	1:B:60:ASP:O	2.18	0.44
1:A:54:LYS:HB2	1:A:54:LYS:HE2	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 (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	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%)	214 (99%)	3 (1%)	74	45
1	B	215/221 (97%)	208 (97%)	7 (3%)	45	10
All	All	432/442 (98%)	422 (98%)	10 (2%)	61	21

All (10) 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	B	108[A]	MET
1	B	108[B]	MET
1	B	139	ARG
1	B	160	ASN
1	B	186	LEU
1	B	194	ARG
1	B	230	LEU

Some 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 carbohydrates 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 (i)

6.1 Protein, DNA and RNA chains (i)

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%)	0.34	16 (6%)	21	18	10, 17, 38, 69	0
1	B	243/249 (97%)	0.47	21 (8%)	13	11	11, 17, 42, 78	0
All	All	483/498 (96%)	0.40	37 (7%)	16	14	10, 17, 41, 78	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	185	THR	11.7
1	B	247	LEU	10.2
1	B	1	PRO	8.3
1	A	1	PRO	7.3
1	A	247	LEU	6.8
1	A	3	TYR	4.4
1	B	182	ASP	4.4
1	B	186	LEU	4.3
1	A	189	ASN	4.2
1	A	213	SER	3.9
1	B	191	GLU	3.8
1	B	22	ARG	3.7
1	A	26	GLN	3.5
1	A	180	SER	3.1
1	A	192	ASN	3.1
1	A	190	LYS	3.0
1	A	211	GLY	3.0
1	B	192	ASN	3.0
1	B	183	HIS	3.0
1	B	189	ASN	2.7
1	B	203	ASN	2.7
1	A	2	ARG	2.7
1	B	129	VAL	2.6
1	A	183	HIS	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	180	SER	2.5
1	B	184	GLU	2.5
1	A	4	LEU	2.4
1	B	211	GLY	2.4
1	B	130	LEU	2.4
1	B	215	ARG	2.3
1	A	216	ASN	2.2
1	A	41	LYS	2.1
1	B	48	ILE	2.1
1	B	131	LEU	2.1
1	A	215	ARG	2.1
1	B	172	GLY	2.1
1	B	81	ILE	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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å^2)	Q<0.9
2	ZN	B	301	1/1	0.97	0.04	-	22,22,22,22	0
2	ZN	A	301	1/1	0.96	0.04	-	25,25,25,25	0

6.5 Other polymers (i)

There are no such residues in this entry.