wwPDB X-ray Structure Validation Summary Report (i)

May 13, 2020 – 12:41 pm BST

PDB ID	:	3LLQ
Title	:	Aquaporin structure from plant pathogen Agrobacterium Tumerfaciens
Authors	:	Liu, Q.; Hillerich, B.; Love, J.; New York Consortium on Membrane Protein Structure (NYCOMPS)
Deposited on	:	2010-01-29
Resolution	:	2.01 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

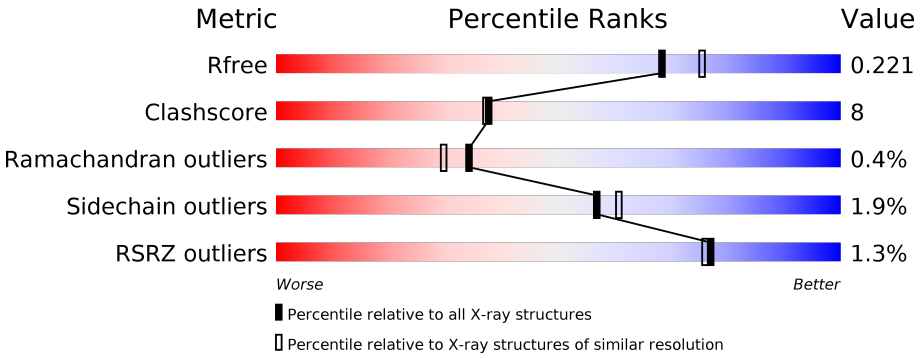
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.01 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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (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 on 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 <=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	256	% 70% 17% • 11%
1	B	256	% 71% 18% • 9%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 3395 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 Aquaporin Z 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	228	Total	C	N	O	S	0	0	0
			1642	1094	265	280	3			
1	B	233	Total	C	N	O	S	0	0	0
			1691	1130	271	287	3			

There are 56 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-27	MET	-	expression tag	UNP Q8UJW4
A	-26	ASP	-	expression tag	UNP Q8UJW4
A	-25	TYR	-	expression tag	UNP Q8UJW4
A	-24	LYS	-	expression tag	UNP Q8UJW4
A	-23	ASP	-	expression tag	UNP Q8UJW4
A	-22	ASP	-	expression tag	UNP Q8UJW4
A	-21	ASP	-	expression tag	UNP Q8UJW4
A	-20	ASP	-	expression tag	UNP Q8UJW4
A	-19	LYS	-	expression tag	UNP Q8UJW4
A	-18	HIS	-	expression tag	UNP Q8UJW4
A	-17	HIS	-	expression tag	UNP Q8UJW4
A	-16	HIS	-	expression tag	UNP Q8UJW4
A	-15	HIS	-	expression tag	UNP Q8UJW4
A	-14	HIS	-	expression tag	UNP Q8UJW4
A	-13	HIS	-	expression tag	UNP Q8UJW4
A	-12	HIS	-	expression tag	UNP Q8UJW4
A	-11	HIS	-	expression tag	UNP Q8UJW4
A	-10	HIS	-	expression tag	UNP Q8UJW4
A	-9	HIS	-	expression tag	UNP Q8UJW4
A	-8	GLU	-	expression tag	UNP Q8UJW4
A	-7	ASN	-	expression tag	UNP Q8UJW4
A	-6	LEU	-	expression tag	UNP Q8UJW4
A	-5	TYR	-	expression tag	UNP Q8UJW4
A	-4	PHE	-	expression tag	UNP Q8UJW4
A	-3	GLN	-	expression tag	UNP Q8UJW4

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	expression tag	UNP Q8UJW4
A	-1	TYR	-	expression tag	UNP Q8UJW4
A	0	VAL	-	expression tag	UNP Q8UJW4
B	-27	MET	-	expression tag	UNP Q8UJW4
B	-26	ASP	-	expression tag	UNP Q8UJW4
B	-25	TYR	-	expression tag	UNP Q8UJW4
B	-24	LYS	-	expression tag	UNP Q8UJW4
B	-23	ASP	-	expression tag	UNP Q8UJW4
B	-22	ASP	-	expression tag	UNP Q8UJW4
B	-21	ASP	-	expression tag	UNP Q8UJW4
B	-20	ASP	-	expression tag	UNP Q8UJW4
B	-19	LYS	-	expression tag	UNP Q8UJW4
B	-18	HIS	-	expression tag	UNP Q8UJW4
B	-17	HIS	-	expression tag	UNP Q8UJW4
B	-16	HIS	-	expression tag	UNP Q8UJW4
B	-15	HIS	-	expression tag	UNP Q8UJW4
B	-14	HIS	-	expression tag	UNP Q8UJW4
B	-13	HIS	-	expression tag	UNP Q8UJW4
B	-12	HIS	-	expression tag	UNP Q8UJW4
B	-11	HIS	-	expression tag	UNP Q8UJW4
B	-10	HIS	-	expression tag	UNP Q8UJW4
B	-9	HIS	-	expression tag	UNP Q8UJW4
B	-8	GLU	-	expression tag	UNP Q8UJW4
B	-7	ASN	-	expression tag	UNP Q8UJW4
B	-6	LEU	-	expression tag	UNP Q8UJW4
B	-5	TYR	-	expression tag	UNP Q8UJW4
B	-4	PHE	-	expression tag	UNP Q8UJW4
B	-3	GLN	-	expression tag	UNP Q8UJW4
B	-2	SER	-	expression tag	UNP Q8UJW4
B	-1	TYR	-	expression tag	UNP Q8UJW4
B	0	VAL	-	expression tag	UNP Q8UJW4

- Molecule 2 is water.

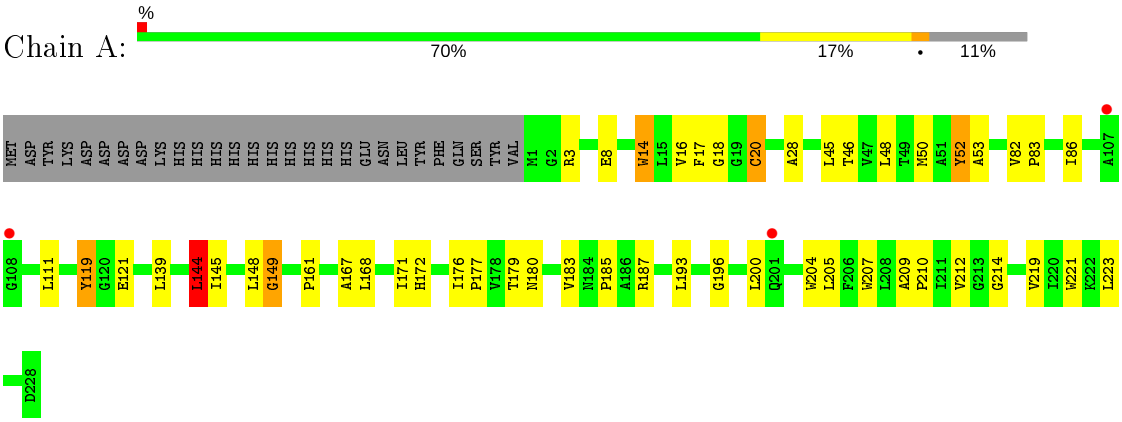
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	24	Total O 24 24	0	0
2	B	38	Total O 38 38	0	0

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.

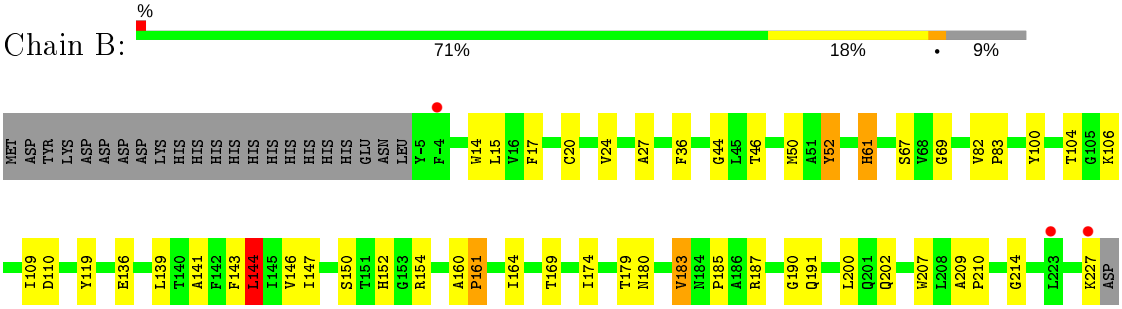
- Molecule 1: Aquaporin Z 2

Chain A:



- Molecule 1: Aquaporin Z 2

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	90.50Å 102.23Å 148.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	31.18 – 2.01 28.73 – 2.01	Depositor EDS
% Data completeness (in resolution range)	93.1 (31.18-2.01) 93.1 (28.73-2.01)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.59 (at 2.01Å)	Xtriage
Refinement program	REFMAC 5.4.0067	Depositor
R, R_{free}	0.188 , 0.219 0.191 , 0.221	Depositor DCC
R_{free} test set	2201 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å^2)	28.2	Xtriage
Anisotropy	0.907	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 60.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	3395	wwPDB-VP
Average B, all atoms (Å^2)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.13% 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

5.1 Standard geometry

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	1.44	11/1687 (0.7%)	0.99	4/2305 (0.2%)
1	B	1.36	14/1739 (0.8%)	0.91	2/2376 (0.1%)
All	All	1.40	25/3426 (0.7%)	0.95	6/4681 (0.1%)

The worst 5 of 25 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	36	PHE	CG-CD2	7.21	1.49	1.38
1	A	45	LEU	CB-CG	6.94	1.72	1.52
1	B	143	PHE	CD2-CE2	6.82	1.52	1.39
1	A	28	ALA	CA-CB	6.69	1.66	1.52
1	A	149	GLY	N-CA	6.67	1.56	1.46

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	144	LEU	CA-CB-CG	-7.20	98.73	115.30
1	A	144	LEU	CB-CG-CD1	6.54	122.11	111.00
1	A	144	LEU	CA-CB-CG	-6.52	100.31	115.30
1	A	148	LEU	CB-CG-CD2	-5.56	101.55	111.00
1	A	45	LEU	CB-CG-CD1	-5.52	101.61	111.00

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	1642	0	1682	27	0
1	B	1691	0	1727	28	0
2	A	24	0	0	0	0
2	B	38	0	0	0	0
All	All	3395	0	3409	52	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 8.

The worst 5 of 52 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:144:LEU:HD13	1:B:214:GLY:HA2	1.65	0.77
1:A:144:LEU:HD13	1:A:214:GLY:HA2	1.69	0.73
1:B:147:ILE:HA	1:B:164:ILE:HD11	1.81	0.63
1:B:61:HIS:HD2	1:B:67:SER:OG	1.81	0.63
1:A:144:LEU:HD13	1:A:214:GLY:CA	2.31	0.59

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	226/256 (88%)	217 (96%)	8 (4%)	1 (0%)	34	30
1	B	231/256 (90%)	224 (97%)	6 (3%)	1 (0%)	34	30
All	All	457/512 (89%)	441 (96%)	14 (3%)	2 (0%)	34	30

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	183	VAL

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Mol	Chain	Res	Type
1	A	183	VAL

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	158/186 (85%)	155 (98%)	3 (2%)	57	61
1	B	163/186 (88%)	160 (98%)	3 (2%)	59	63
All	All	321/372 (86%)	315 (98%)	6 (2%)	57	61

5 of 6 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	187	ARG
1	B	187	ARG
1	B	61	HIS
1	A	144	LEU
1	B	144	LEU

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

Mol	Chain	Res	Type
1	A	172	HIS
1	A	191	GLN
1	B	61	HIS
1	B	180	ASN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

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^{th} 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	228/256 (89%)	-0.46	3 (1%)	77	76	19, 31, 43, 59	0
1	B	233/256 (91%)	-0.41	3 (1%)	77	76	21, 30, 43, 55	0
All	All	461/512 (90%)	-0.43	6 (1%)	77	76	19, 30, 43, 59	0

The worst 5 of 6 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	108	GLY	3.0
1	B	-4	PHE	2.8
1	B	227	LYS	2.6
1	B	223	LEU	2.5
1	A	107	ALA	2.2

6.2 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.