Full wwPDB X-ray Structure Validation Report (i)

Nov 2, 2021 – 05:50 AM EDT

PDB ID	:	2ZPL
Title	:	Crystal structure analysis of PDZ domain A
Authors	:	Inaba, K.; Suzuki, M.
Deposited on	:	2008-07-17
Resolution	:	1.70 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 (i) symbol.

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

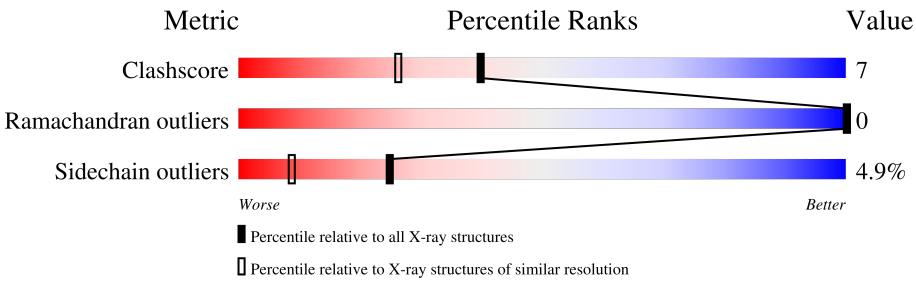
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 1.70 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))
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	97	80% 13% • 5%
1	B	97	87% 10% •
1	C	97	66% 23% • 8%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	GOL	B	222	-	-	X	-

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 2244 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 Regulator of sigma E protease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	Se			
1	A	92	709	442	125	141	1	0	1	0
1	B	94	716	445	127	143	1	0	0	0
1	C	89	682	426	121	134	1	0	1	0

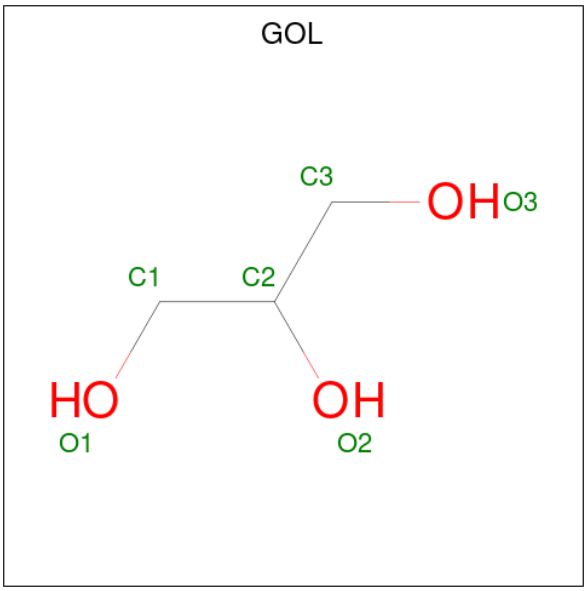
There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	125	GLY	-	expression tag	UNP P0AEH1
A	126	SER	-	expression tag	UNP P0AEH1
A	169	MSE	LEU	engineered mutation	UNP P0AEH1
B	125	GLY	-	expression tag	UNP P0AEH1
B	126	SER	-	expression tag	UNP P0AEH1
B	169	MSE	LEU	engineered mutation	UNP P0AEH1
C	125	GLY	-	expression tag	UNP P0AEH1
C	126	SER	-	expression tag	UNP P0AEH1
C	169	MSE	LEU	engineered mutation	UNP P0AEH1

- Molecule 2 is NICKEL (II) ION (three-letter code: NI) (formula: Ni).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Ni		
2	A	1	1	1	0	0
2	B	1	1	1	0	0
2	C	1	1	1	0	0

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



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

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	46	46	46	0	0
			Total	O		
4	B	51	51	51	0	0
			Total	O		
4	C	25	25	25	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. 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. 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: Regulator of sigma E protease

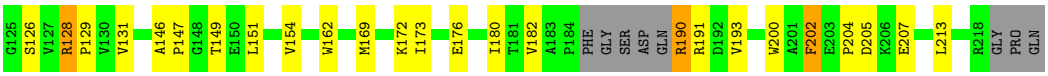
Chain A:

• Molecule 1: Regulator of sigma E protease

Chain B:

• Molecule 1: Regulator of sigma E protease

Chain C:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 31	Depositor
Cell constants a, b, c, α, β, γ	54.76Å 54.76Å 75.64Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	18.55 – 1.70 18.55 – 1.70	Depositor EDS
% Data completeness (in resolution range)	99.0 (18.55-1.70) 94.2 (18.55-1.70)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.68 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.5.0035	Depositor
R, R_{free}	0.150 , 0.175 0.211 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	26.9	Xtriage
Anisotropy	0.091	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.40 , 45.7	EDS
L-test for twinning[2]	$< \|L\| > = 0.56$, $< L^2 > = 0.41$	Xtriage
Estimated twinning fraction	0.000 for -h,-k,l 0.020 for h,-h-k,-l 0.000 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	2244	wwPDB-VP
Average B, all atoms (Å^2)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.88% 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: GOL, NI

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	0.91	0/724	0.96	2/984 (0.2%)
1	B	0.90	0/728	0.92	0/989
1	C	0.83	0/695	0.85	0/944
All	All	0.88	0/2147	0.91	2/2917 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	196	ASP	CB-CG-OD1	5.17	122.96	118.30
1	A	161	ASP	CB-CG-OD1	5.07	122.86	118.30

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	709	0	703	5	0
1	B	716	0	706	5	0
1	C	682	0	685	18	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	6	0	8	4	0
3	C	6	0	8	1	0
4	A	46	0	0	1	0
4	B	51	0	0	3	0
4	C	25	0	0	0	0
All	All	2244	0	2110	31	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 (31) 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:133:GLU:HB2	1:A:216:ARG:HD3	1.53	0.89
1:B:161:ASP:HB2	3:B:222:GOL:H32	1.56	0.87
1:C:202:PHE:HB2	1:C:207:GLU:OE1	1.84	0.77
1:A:154:VAL:HG22	1:A:180:ILE:HD12	1.68	0.76
3:B:222:GOL:C3	4:B:27:HOH:O	2.41	0.68
1:A:204:PRO:HD2	4:A:254:HOH:O	2.01	0.60
3:B:222:GOL:H31	4:B:27:HOH:O	2.00	0.58
3:B:222:GOL:H32	4:B:27:HOH:O	2.05	0.57
1:C:200:TRP:O	3:C:1:GOL:H11	2.05	0.56
1:C:190:ARG:CG	1:C:190:ARG:HH11	2.18	0.55
1:C:128:ARG:HB3	1:C:129:PRO:CD	2.38	0.54
1:C:128:ARG:HB3	1:C:129:PRO:HD2	1.91	0.52
1:C:191:ARG:CZ	1:C:193:VAL:HG12	2.41	0.50
1:A:128:ARG:HD2	1:A:150:GLU:OE2	2.11	0.50
1:C:154:VAL:HG22	1:C:180:ILE:HD12	1.94	0.50
1:C:190:ARG:HG2	1:C:190:ARG:NH1	2.26	0.49
1:C:131[B]:VAL:HG23	1:C:147:PRO:HA	1.96	0.48
1:C:190:ARG:CG	1:C:190:ARG:NH1	2.77	0.48
1:B:173:ILE:HD13	1:B:204:PRO:HG3	1.96	0.47
1:A:166:ARG:HG2	1:A:209:PRO:HG2	1.97	0.46
1:C:129:PRO:HG2	1:C:151:LEU:O	2.15	0.45
1:C:154:VAL:HG12	1:C:172:LYS:NZ	2.31	0.45
1:C:169:MSE:HE2	1:C:213:LEU:HD11	1.98	0.44
1:C:129:PRO:HA	1:C:162:TRP:NE1	2.32	0.44
1:B:154:VAL:HG22	1:B:180:ILE:HD12	2.00	0.44
1:C:129:PRO:HA	1:C:162:TRP:CE2	2.54	0.43
1:C:131[B]:VAL:CG2	1:C:146:ALA:O	2.68	0.42
1:C:149:THR:CG2	1:C:182:VAL:HB	2.49	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:133:GLU:HB2	1:B:216:ARG:HB2	2.01	0.42
1:B:172:LYS:O	1:B:175:ASP:HB2	2.21	0.41
1:C:173:ILE:CD1	1:C:204:PRO:HG3	2.52	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	91/97 (94%)	90 (99%)	1 (1%)	0	100	100
1	B	92/97 (95%)	92 (100%)	0	0	100	100
1	C	86/97 (89%)	85 (99%)	1 (1%)	0	100	100
All	All	269/291 (92%)	267 (99%)	2 (1%)	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	77/78 (99%)	72 (94%)	5 (6%)	17	4
1	B	77/78 (99%)	76 (99%)	1 (1%)	69	56
1	C	74/78 (95%)	68 (92%)	6 (8%)	11	2

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	228/234 (97%)	216 (95%)	12 (5%)	25 7

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	142	GLU
1	A	177[A]	SER
1	A	177[B]	SER
1	A	216	ARG
1	A	218	ARG
1	B	177	SER
1	C	126	SER
1	C	128	ARG
1	C	176	GLU
1	C	190	ARG
1	C	202	PHE
1	C	205	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 5 ligands modelled in this entry, 3 are monoatomic - leaving 2 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	$\#\|Z\| > 2$
3	GOL	C	1	-	5,5,5	0.43	0	5,5,5	1.28	0
3	GOL	B	222	-	5,5,5	0.41	0	5,5,5	1.54	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	GOL	C	1	-	-	4/4/4/4	-
3	GOL	B	222	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	222	GOL	O1-C1-C2-C3
3	C	1	GOL	C1-C2-C3-O3
3	C	1	GOL	O2-C2-C3-O3
3	C	1	GOL	O1-C1-C2-O2
3	B	222	GOL	O2-C2-C3-O3
3	C	1	GOL	O1-C1-C2-C3

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	1	GOL	1	0
3	B	222	GOL	4	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 (i)

6.1 Protein, DNA and RNA chains (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands (i)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers (i)

Unable to reproduce the depositors R factor - this section is therefore empty.