



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 22, 2023 – 02:33 PM EDT

PDB ID : 2QYG  
Title : Crystal Structure of a RuBisCO-like Protein rlp2 from *Rhodospseudomonas palustris*  
Authors : Li, H.; Chan, S.; Tabita, F.R.; Eisenberg, D.  
Deposited on : 2007-08-14  
Resolution : 3.30 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](mailto: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>.

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

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.35  
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) : 2.35

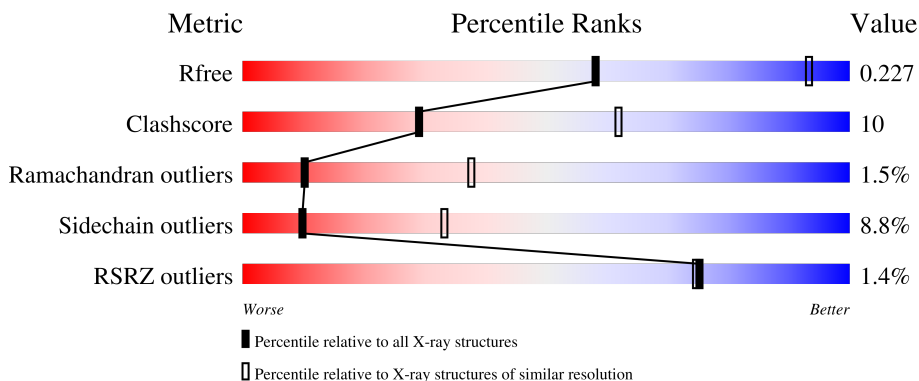
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.30 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	1149 (3.34-3.26)
Clashscore	141614	1205 (3.34-3.26)
Ramachandran outliers	138981	1183 (3.34-3.26)
Sidechain outliers	138945	1182 (3.34-3.26)
RSRZ outliers	127900	1115 (3.34-3.26)

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  $\geq 3$ , 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	452	 72% 21% • 5%
1	B	452	 74% 18% • 5%
1	C	452	 74% 18% • 5%
1	D	452	 70% 22% • 5%

## 2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 13012 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 Ribulose biphosphate carboxylase-like protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	429	3253	2076	575	582	20	0	0	0
1	B	429	3253	2076	575	582	20	0	0	0
1	C	429	3253	2076	575	582	20	0	0	0
1	D	429	3253	2076	575	582	20	0	0	0

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	expression tag	UNP Q6ND47
A	-18	GLY	-	expression tag	UNP Q6ND47
A	-17	SER	-	expression tag	UNP Q6ND47
A	-16	SER	-	expression tag	UNP Q6ND47
A	-15	HIS	-	expression tag	UNP Q6ND47
A	-14	HIS	-	expression tag	UNP Q6ND47
A	-13	HIS	-	expression tag	UNP Q6ND47
A	-12	HIS	-	expression tag	UNP Q6ND47
A	-11	HIS	-	expression tag	UNP Q6ND47
A	-10	HIS	-	expression tag	UNP Q6ND47
A	-9	SER	-	expression tag	UNP Q6ND47
A	-8	SER	-	expression tag	UNP Q6ND47
A	-7	GLY	-	expression tag	UNP Q6ND47
A	-6	LEU	-	expression tag	UNP Q6ND47
A	-5	VAL	-	expression tag	UNP Q6ND47
A	-4	PRO	-	expression tag	UNP Q6ND47
A	-3	ARG	-	expression tag	UNP Q6ND47
A	-2	GLY	-	expression tag	UNP Q6ND47
A	-1	SER	-	expression tag	UNP Q6ND47
A	0	HIS	-	expression tag	UNP Q6ND47
B	-19	MET	-	expression tag	UNP Q6ND47

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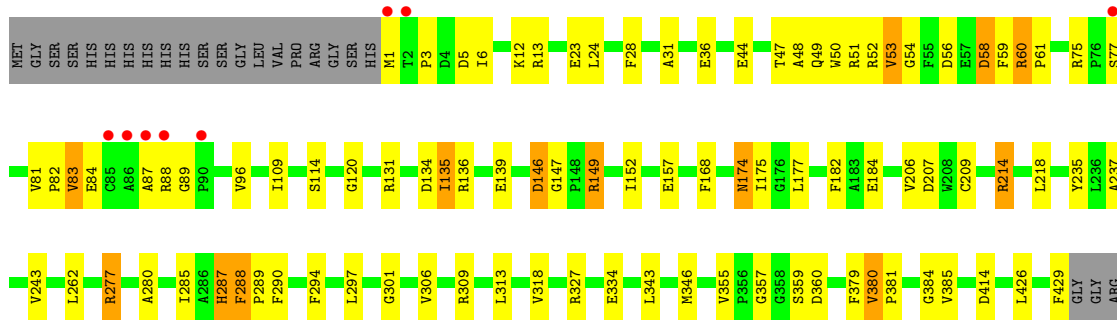
Chain	Residue	Modelled	Actual	Comment	Reference
B	-18	GLY	-	expression tag	UNP Q6ND47
B	-17	SER	-	expression tag	UNP Q6ND47
B	-16	SER	-	expression tag	UNP Q6ND47
B	-15	HIS	-	expression tag	UNP Q6ND47
B	-14	HIS	-	expression tag	UNP Q6ND47
B	-13	HIS	-	expression tag	UNP Q6ND47
B	-12	HIS	-	expression tag	UNP Q6ND47
B	-11	HIS	-	expression tag	UNP Q6ND47
B	-10	HIS	-	expression tag	UNP Q6ND47
B	-9	SER	-	expression tag	UNP Q6ND47
B	-8	SER	-	expression tag	UNP Q6ND47
B	-7	GLY	-	expression tag	UNP Q6ND47
B	-6	LEU	-	expression tag	UNP Q6ND47
B	-5	VAL	-	expression tag	UNP Q6ND47
B	-4	PRO	-	expression tag	UNP Q6ND47
B	-3	ARG	-	expression tag	UNP Q6ND47
B	-2	GLY	-	expression tag	UNP Q6ND47
B	-1	SER	-	expression tag	UNP Q6ND47
B	0	HIS	-	expression tag	UNP Q6ND47
C	-19	MET	-	expression tag	UNP Q6ND47
C	-18	GLY	-	expression tag	UNP Q6ND47
C	-17	SER	-	expression tag	UNP Q6ND47
C	-16	SER	-	expression tag	UNP Q6ND47
C	-15	HIS	-	expression tag	UNP Q6ND47
C	-14	HIS	-	expression tag	UNP Q6ND47
C	-13	HIS	-	expression tag	UNP Q6ND47
C	-12	HIS	-	expression tag	UNP Q6ND47
C	-11	HIS	-	expression tag	UNP Q6ND47
C	-10	HIS	-	expression tag	UNP Q6ND47
C	-9	SER	-	expression tag	UNP Q6ND47
C	-8	SER	-	expression tag	UNP Q6ND47
C	-7	GLY	-	expression tag	UNP Q6ND47
C	-6	LEU	-	expression tag	UNP Q6ND47
C	-5	VAL	-	expression tag	UNP Q6ND47
C	-4	PRO	-	expression tag	UNP Q6ND47
C	-3	ARG	-	expression tag	UNP Q6ND47
C	-2	GLY	-	expression tag	UNP Q6ND47
C	-1	SER	-	expression tag	UNP Q6ND47
C	0	HIS	-	expression tag	UNP Q6ND47
D	-19	MET	-	expression tag	UNP Q6ND47
D	-18	GLY	-	expression tag	UNP Q6ND47
D	-17	SER	-	expression tag	UNP Q6ND47

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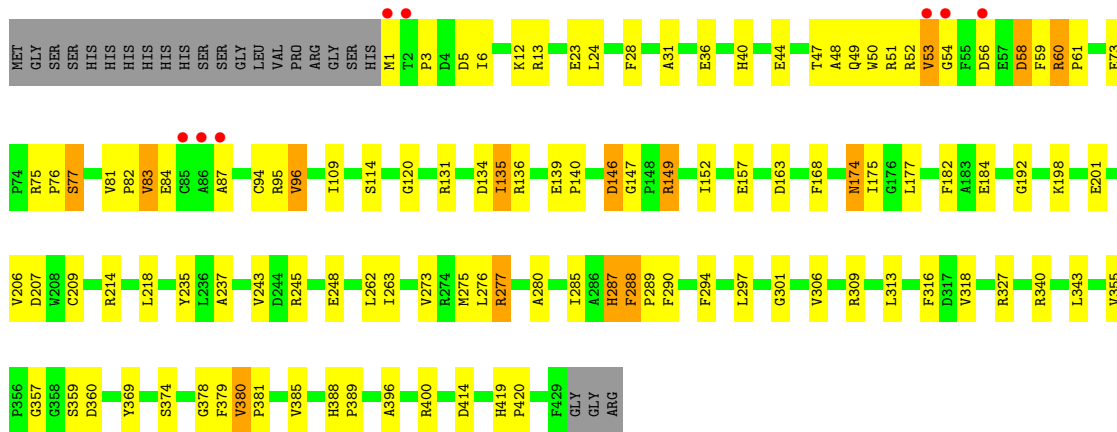
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Chain	Residue	Modelled	Actual	Comment	Reference
D	-16	SER	-	expression tag	UNP Q6ND47
D	-15	HIS	-	expression tag	UNP Q6ND47
D	-14	HIS	-	expression tag	UNP Q6ND47
D	-13	HIS	-	expression tag	UNP Q6ND47
D	-12	HIS	-	expression tag	UNP Q6ND47
D	-11	HIS	-	expression tag	UNP Q6ND47
D	-10	HIS	-	expression tag	UNP Q6ND47
D	-9	SER	-	expression tag	UNP Q6ND47
D	-8	SER	-	expression tag	UNP Q6ND47
D	-7	GLY	-	expression tag	UNP Q6ND47
D	-6	LEU	-	expression tag	UNP Q6ND47
D	-5	VAL	-	expression tag	UNP Q6ND47
D	-4	PRO	-	expression tag	UNP Q6ND47
D	-3	ARG	-	expression tag	UNP Q6ND47
D	-2	GLY	-	expression tag	UNP Q6ND47
D	-1	SER	-	expression tag	UNP Q6ND47
D	0	HIS	-	expression tag	UNP Q6ND47





● Molecule 1: Ribulose biphosphate carboxylase-like protein 2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	68.66Å 119.53Å 203.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	77.38 – 3.30 77.38 – 3.26	Depositor EDS
% Data completeness (in resolution range)	99.7 (77.38-3.30) 98.0 (77.38-3.26)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.16	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.37 (at 3.26Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.203 , 0.232 0.202 , 0.227	Depositor DCC
$R_{free}$ test set	1336 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	43.5	Xtrriage
Anisotropy	0.158	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 23.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.90	EDS
Total number of atoms	13012	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	35.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.97% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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](#)

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	0.60	0/3344	0.68	0/4554
1	B	0.56	0/3344	0.67	0/4554
1	C	0.60	0/3344	0.67	0/4554
1	D	0.61	1/3344 (0.0%)	0.68	0/4554
All	All	0.59	1/13376 (0.0%)	0.68	0/18216

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	94	CYS	CB-SG	-5.04	1.73	1.81

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	3253	0	3200	73	0
1	B	3253	0	3200	59	0
1	C	3253	0	3200	59	0
1	D	3253	0	3200	76	0
All	All	13012	0	12800	248	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 10.

The worst 5 of 248 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:177:LEU:HD21	1:B:52:ARG:HD2	1.44	0.99
1:C:285:ILE:HG13	1:C:318:VAL:HB	1.55	0.89
1:C:58:ASP:OD1	1:C:60:ARG:HB2	1.73	0.88
1:A:285:ILE:HG13	1:A:318:VAL:HB	1.56	0.86
1:D:58:ASP:OD1	1:D:60:ARG:HB2	1.77	0.85

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	427/452 (94%)	393 (92%)	28 (7%)	6 (1%)	11 38
1	B	427/452 (94%)	391 (92%)	30 (7%)	6 (1%)	11 38
1	C	427/452 (94%)	391 (92%)	29 (7%)	7 (2%)	9 36
1	D	427/452 (94%)	395 (92%)	25 (6%)	7 (2%)	9 36
All	All	1708/1808 (94%)	1570 (92%)	112 (7%)	26 (2%)	10 38

5 of 26 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	53	VAL
1	B	53	VAL
1	C	53	VAL
1	D	53	VAL
1	A	58	ASP

### 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	331/349 (95%)	303 (92%)	28 (8%)	10	35
1	B	331/349 (95%)	302 (91%)	29 (9%)	10	33
1	C	331/349 (95%)	301 (91%)	30 (9%)	9	31
1	D	331/349 (95%)	302 (91%)	29 (9%)	10	33
All	All	1324/1396 (95%)	1208 (91%)	116 (9%)	10	33

5 of 116 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	12	LYS
1	D	297	LEU
1	C	157	GLU
1	D	287	HIS
1	D	146	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	367	ASN
1	D	174	ASN
1	C	104	ASN
1	D	367	ASN
1	C	367	ASN

### 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](#)

There are no ligands in this entry.

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	429/452 (94%)	-0.15	2 (0%) 91 91	22, 33, 50, 68	0
1	B	429/452 (94%)	0.10	6 (1%) 75 75	22, 33, 50, 68	0
1	C	429/452 (94%)	0.01	8 (1%) 66 65	21, 33, 50, 68	0
1	D	429/452 (94%)	-0.06	8 (1%) 66 65	22, 33, 50, 68	0
All	All	1716/1808 (94%)	-0.03	24 (1%) 75 75	21, 33, 50, 68	0

The worst 5 of 24 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	87	ALA	5.6
1	D	1	MET	4.9
1	B	86	ALA	4.7
1	C	86	ALA	4.5
1	C	1	MET	4.0

### 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.