



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 15, 2026 – 12:57 AM UTC

PDB ID : 9XG1 / pdb_00009xg1
Title : Crystal structure of protein-asparaginase from *Amycolatopsis deserti*
Authors : Yamaguchi, H.; Ono, T.; Takahashi, K.
Deposited on : 2025-10-29
Resolution : 2.08 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

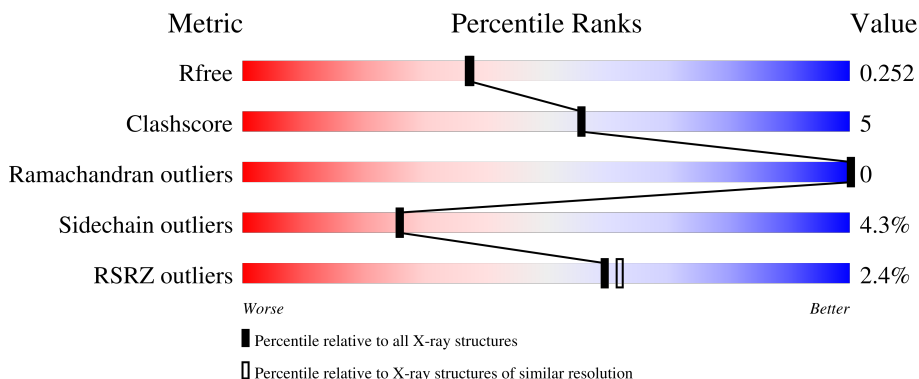
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

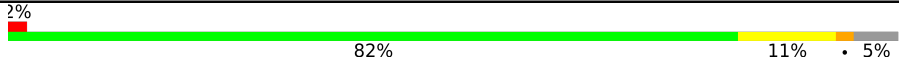
The reported resolution of this entry is 2.08 Å.

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	8172 (2.10-2.06)
Clashscore	190562	8714 (2.10-2.06)
Ramachandran outliers	187476	8641 (2.10-2.06)
Sidechain outliers	187428	8642 (2.10-2.06)
RSRZ outliers	180081	8177 (2.10-2.06)

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	793	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5743 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 Protein-asparaginase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	753	Total	C	N	O	S	0	0	0
			5483	3406	970	1089	18			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	786	LEU	-	expression tag	UNP A0ABQ3IKU5
A	787	GLU	-	expression tag	UNP A0ABQ3IKU5
A	788	HIS	-	expression tag	UNP A0ABQ3IKU5
A	789	HIS	-	expression tag	UNP A0ABQ3IKU5
A	790	HIS	-	expression tag	UNP A0ABQ3IKU5
A	791	HIS	-	expression tag	UNP A0ABQ3IKU5
A	792	HIS	-	expression tag	UNP A0ABQ3IKU5
A	793	HIS	-	expression tag	UNP A0ABQ3IKU5

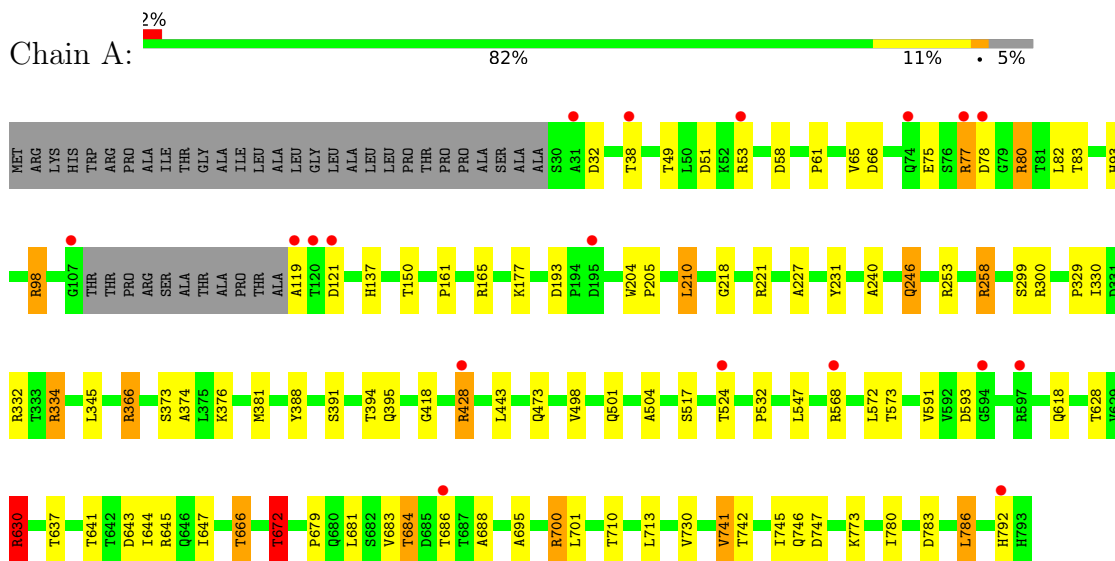
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	260	Total	O	0	0
			260	260		

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: Protein-asparaginase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	53.65Å 99.75Å 114.28Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.62 – 2.08 48.62 – 2.08	Depositor EDS
% Data completeness (in resolution range)	100.0 (48.62-2.08) 100.0 (48.62-2.08)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.16 (at 2.08Å)	Xtriage
Refinement program	REFMAC 5.8.0405	Depositor
R, R_{free}	0.180 , 0.244 0.194 , 0.252	Depositor DCC
R_{free} test set	1910 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	21.5	Xtriage
Anisotropy	0.556	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 46.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5743	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.42% 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

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	0.78	0/5601	1.16	10/7679 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	12

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	329	PRO	CB-CA-C	-6.15	102.89	110.95
1	A	637	THR	CA-CB-OG1	-6.04	100.55	109.60
1	A	334	ARG	CB-CA-C	5.89	116.12	111.00
1	A	93	HIS	CA-CB-CG	-5.81	107.99	113.80
1	A	747	ASP	CA-CB-CG	5.66	118.26	112.60
1	A	684	THR	CB-CA-C	5.60	120.36	109.33
1	A	137	HIS	CA-CB-CG	-5.57	108.23	113.80
1	A	672	THR	CA-CB-OG1	-5.32	101.62	109.60
1	A	374	ALA	N-CA-C	5.24	117.78	109.50
1	A	246	GLN	CB-CA-C	5.13	119.96	109.55

There are no chirality outliers.

All (12) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	165	ARG	Sidechain
1	A	221	ARG	Sidechain
1	A	253	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	A	258	ARG	Sidechain
1	A	332	ARG	Sidechain
1	A	334	ARG	Sidechain
1	A	366	ARG	Sidechain
1	A	428	ARG	Sidechain
1	A	630	ARG	Sidechain
1	A	700	ARG	Sidechain
1	A	77	ARG	Sidechain
1	A	80	ARG	Sidechain

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	5483	0	5353	51	0
2	A	260	0	0	3	0
All	All	5743	0	5353	51	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 5.

All (51) 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:686:THR:HB	2:A:1005:HOH:O	1.63	0.98
1:A:783:ASP:HB3	1:A:786:LEU:HD22	1.59	0.83
1:A:628:THR:HG22	1:A:630:ARG:HD3	1.65	0.78
1:A:524:THR:HG23	2:A:876:HOH:O	1.92	0.69
1:A:193:ASP:HB2	1:A:210:LEU:HD22	1.82	0.61
1:A:710:THR:HG23	2:A:970:HOH:O	2.01	0.60
1:A:373:SER:HB2	1:A:672:THR:HG22	1.84	0.58
1:A:58:ASP:CG	1:A:299:SER:HB2	2.30	0.57
1:A:98:ARG:HB3	1:A:98:ARG:HH21	1.69	0.56
1:A:366:ARG:HG2	1:A:473:GLN:HG3	1.87	0.55
1:A:524:THR:OG1	1:A:532:PRO:HD3	2.06	0.55
1:A:792:HIS:HD1	1:A:792:HIS:C	2.15	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:345:LEU:HD11	1:A:381:MET:HE3	1.89	0.54
1:A:300:ARG:HG2	1:A:330:ILE:HD13	1.88	0.54
1:A:568:ARG:HH11	1:A:568:ARG:HG2	1.73	0.53
1:A:218:GLY:HA2	1:A:391:SER:OG	2.10	0.52
1:A:730:VAL:HG22	1:A:741:VAL:HG21	1.92	0.51
1:A:792:HIS:C	1:A:792:HIS:ND1	2.68	0.51
1:A:568:ARG:HG2	1:A:568:ARG:NH1	2.27	0.50
1:A:572:LEU:C	1:A:572:LEU:HD23	2.38	0.48
1:A:792:HIS:ND1	1:A:792:HIS:O	2.46	0.48
1:A:591:VAL:HG12	1:A:647:ILE:CD1	2.44	0.48
1:A:193:ASP:CB	1:A:210:LEU:HD22	2.45	0.47
1:A:679:PRO:HB2	1:A:701:LEU:HD22	1.98	0.46
1:A:683:VAL:O	1:A:773:LYS:HE3	2.15	0.46
1:A:713:LEU:CD2	1:A:741:VAL:HG11	2.45	0.46
1:A:391:SER:O	1:A:395:GLN:HG3	2.16	0.46
1:A:227:ALA:HA	1:A:231:TYR:O	2.16	0.45
1:A:573:THR:OG1	1:A:666:THR:HG23	2.15	0.45
1:A:193:ASP:HB2	1:A:210:LEU:CD2	2.46	0.45
1:A:498:VAL:CG2	1:A:547:LEU:HD11	2.48	0.44
1:A:388:TYR:HA	1:A:394:THR:OG1	2.18	0.44
1:A:204:TRP:CD1	1:A:240:ALA:HB2	2.53	0.44
1:A:745:ILE:HD13	1:A:780:ILE:HD12	2.00	0.44
1:A:65:VAL:O	1:A:66:ASP:C	2.61	0.44
1:A:504:ALA:O	1:A:517:SER:HA	2.18	0.44
1:A:681:LEU:HA	1:A:700:ARG:O	2.17	0.44
1:A:524:THR:OG1	1:A:532:PRO:CD	2.65	0.43
1:A:641:THR:HA	1:A:644:ILE:HG12	2.01	0.43
1:A:366:ARG:CG	1:A:473:GLN:HG3	2.49	0.43
1:A:593:ASP:OD1	1:A:593:ASP:C	2.61	0.43
1:A:695:ALA:O	1:A:742:THR:HA	2.19	0.42
1:A:498:VAL:HG21	1:A:547:LEU:HD11	2.02	0.42
1:A:643:ASP:OD1	1:A:645:ARG:NE	2.47	0.42
1:A:32:ASP:OD2	1:A:98:ARG:NH2	2.53	0.42
1:A:150:THR:HA	1:A:161:PRO:HB2	2.01	0.41
1:A:204:TRP:HA	1:A:205:PRO:C	2.44	0.41
1:A:119:ALA:HA	1:A:418:GLY:O	2.21	0.41
1:A:688:ALA:O	1:A:780:ILE:HA	2.21	0.41
1:A:61:PRO:HD2	1:A:246:GLN:NE2	2.36	0.40
1:A:75:GLU:HB3	1:A:82:LEU:CD2	2.52	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	749/793 (94%)	720 (96%)	29 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	576/604 (95%)	551 (96%)	25 (4%)	26	26

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	38	THR
1	A	49	THR
1	A	51	ASP
1	A	53	ARG
1	A	77	ARG
1	A	78	ASP
1	A	80	ARG
1	A	83	THR
1	A	98	ARG
1	A	121	ASP
1	A	177	LYS
1	A	210	LEU
1	A	258	ARG

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Mol	Chain	Res	Type
1	A	376	LYS
1	A	428	ARG
1	A	443	LEU
1	A	501	GLN
1	A	618	GLN
1	A	630	ARG
1	A	666	THR
1	A	672	THR
1	A	684	THR
1	A	741	VAL
1	A	746	GLN
1	A	786	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	229	GLN
1	A	395	GLN
1	A	473	GLN
1	A	501	GLN
1	A	618	GLN
1	A	646	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

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 ⓘ

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	753/793 (94%)	-0.00	18 (2%) 59 62	15, 22, 41, 72	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	120	THR	5.1
1	A	78	ASP	3.9
1	A	119	ALA	3.5
1	A	77	ARG	3.1
1	A	428	ARG	2.9
1	A	792	HIS	2.5
1	A	524	THR	2.4
1	A	121	ASP	2.4
1	A	597	ARG	2.4
1	A	568	ARG	2.4
1	A	686	THR	2.2
1	A	594	GLY	2.2
1	A	195	ASP	2.2
1	A	31	ALA	2.1
1	A	38	THR	2.1
1	A	107	GLY	2.1
1	A	74	GLN	2.0
1	A	53	ARG	2.0

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 [i](#)

There are no oligosaccharides 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.