



wwPDB X-ray Structure Validation Summary Report ⓘ

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PDB ID : 5ZSQ / pdb_00005zsq
Title : NifS from Hydrogenimonas thermophila, soaked with L-cysteine for 4 min
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Deposited on : 2018-04-29
Resolution : 3.21 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 ⓘ 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
Mogul	:	2022.3.0, CSD as543be (2022)
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

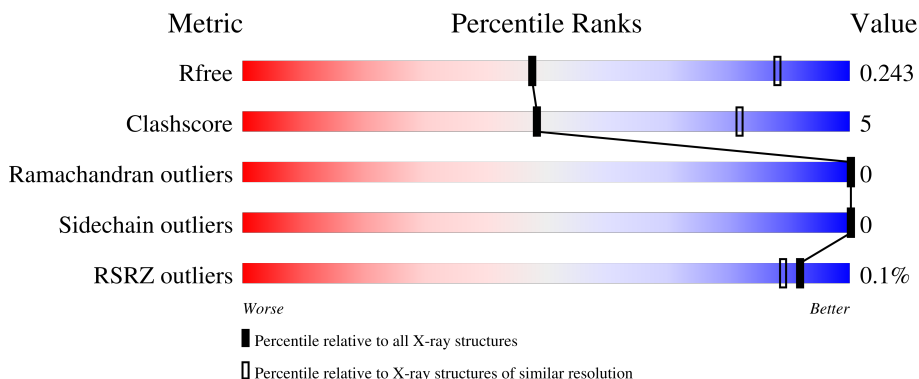
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.21 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	1768 (3.24-3.20)
Clashscore	190562	1879 (3.24-3.20)
Ramachandran outliers	187476	1844 (3.24-3.20)
Sidechain outliers	187428	1843 (3.24-3.20)
RSRZ outliers	180081	1768 (3.24-3.20)

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	415	
1	B	415	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 6034 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 Cysteine desulfurase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	388	Total	C	N	O	P	S	0	0	0
			3016	1891	518	590	1	16			
1	B	386	Total	C	N	O	P	S	0	0	0
			3006	1885	516	588	1	16			

There are 38 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	MET	-	expression tag	UNP A0A1I5NEH3
A	-1	ALA	-	expression tag	UNP A0A1I5NEH3
A	0	HIS	-	expression tag	UNP A0A1I5NEH3
A	397	LEU	-	expression tag	UNP A0A1I5NEH3
A	398	GLU	-	expression tag	UNP A0A1I5NEH3
A	399	VAL	-	expression tag	UNP A0A1I5NEH3
A	400	ASP	-	expression tag	UNP A0A1I5NEH3
A	401	LEU	-	expression tag	UNP A0A1I5NEH3
A	402	VAL	-	expression tag	UNP A0A1I5NEH3
A	403	PRO	-	expression tag	UNP A0A1I5NEH3
A	404	ARG	-	expression tag	UNP A0A1I5NEH3
A	405	GLY	-	expression tag	UNP A0A1I5NEH3
A	406	SER	-	expression tag	UNP A0A1I5NEH3
A	407	HIS	-	expression tag	UNP A0A1I5NEH3
A	408	HIS	-	expression tag	UNP A0A1I5NEH3
A	409	HIS	-	expression tag	UNP A0A1I5NEH3
A	410	HIS	-	expression tag	UNP A0A1I5NEH3
A	411	HIS	-	expression tag	UNP A0A1I5NEH3
A	412	HIS	-	expression tag	UNP A0A1I5NEH3
B	-2	MET	-	expression tag	UNP A0A1I5NEH3
B	-1	ALA	-	expression tag	UNP A0A1I5NEH3
B	0	HIS	-	expression tag	UNP A0A1I5NEH3
B	397	LEU	-	expression tag	UNP A0A1I5NEH3
B	398	GLU	-	expression tag	UNP A0A1I5NEH3
B	399	VAL	-	expression tag	UNP A0A1I5NEH3

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Chain	Residue	Modelled	Actual	Comment	Reference
B	400	ASP	-	expression tag	UNP A0A1I5NEH3
B	401	LEU	-	expression tag	UNP A0A1I5NEH3
B	402	VAL	-	expression tag	UNP A0A1I5NEH3
B	403	PRO	-	expression tag	UNP A0A1I5NEH3
B	404	ARG	-	expression tag	UNP A0A1I5NEH3
B	405	GLY	-	expression tag	UNP A0A1I5NEH3
B	406	SER	-	expression tag	UNP A0A1I5NEH3
B	407	HIS	-	expression tag	UNP A0A1I5NEH3
B	408	HIS	-	expression tag	UNP A0A1I5NEH3
B	409	HIS	-	expression tag	UNP A0A1I5NEH3
B	410	HIS	-	expression tag	UNP A0A1I5NEH3
B	411	HIS	-	expression tag	UNP A0A1I5NEH3
B	412	HIS	-	expression tag	UNP A0A1I5NEH3

- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	6	Total O 6 6	0	0
2	B	6	Total O 6 6	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α , β , γ	137.50Å 137.50Å 98.70Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.01 – 3.21 45.01 – 3.21	Depositor EDS
% Data completeness (in resolution range)	99.9 (45.01-3.21) 99.9 (45.01-3.21)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.87 (at 3.19Å)	Xtriage
Refinement program	PHENIX 1.13_2998	Depositor
R, R_{free}	0.197 , 0.245 0.198 , 0.243	Depositor DCC
R_{free} test set	874 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	75.7	Xtriage
Anisotropy	0.076	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 40.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.041 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	6034	wwPDB-VP
Average B, all atoms (Å ²)	77.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.38% 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

Bond lengths and bond angles in the following residue types are not validated in this section: LLP

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	0.13	0/3051	0.34	0/4139
1	B	0.14	0/3041	0.34	0/4125
All	All	0.14	0/6092	0.34	0/8264

There are no bond length outliers.

There are no bond angle outliers.

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	3016	0	2943	30	0
1	B	3006	0	2933	38	0
2	A	6	0	0	1	0
2	B	6	0	0	1	0
All	All	6034	0	5876	65	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.

The worst 5 of 65 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:94:HIS:HB3	1:B:143:THR:HA	1.77	0.67
1:B:271:ASP:OD1	1:B:289:ARG:NH2	2.27	0.67
1:A:272:LYS:NZ	1:A:365:ASP:OD1	2.28	0.66
1:B:263:GLU:OE2	1:B:267:ARG:NH2	2.31	0.63
1:A:46:LEU:HD11	1:A:242:VAL:HG13	1.80	0.62

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	385/415 (93%)	379 (98%)	6 (2%)	0	100	100
1	B	383/415 (92%)	374 (98%)	9 (2%)	0	100	100
All	All	768/830 (92%)	753 (98%)	15 (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	323/349 (93%)	323 (100%)	0	100	100
1	B	323/349 (93%)	323 (100%)	0	100	100
All	All	646/698 (93%)	646 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	27	GLN
1	A	133	HIS
1	B	27	GLN
1	B	115	GLN
1	B	133	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues are modelled in this entry.

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$
1	LLP	B	204	1	23,24,25	2.52	6 (26%)	25,32,34	1.47	3 (12%)
1	LLP	A	204	1	23,24,25	2.49	6 (26%)	25,32,34	1.45	3 (12%)

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
1	LLP	B	204	1	-	8/16/17/19	0/1/1/1
1	LLP	A	204	1	-	6/16/17/19	0/1/1/1

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	204	LLP	C4-C4'	7.20	1.62	1.46
1	A	204	LLP	C4-C4'	7.13	1.61	1.46
1	A	204	LLP	C4'-NZ	4.92	1.43	1.27
1	B	204	LLP	C4'-NZ	4.91	1.43	1.27
1	A	204	LLP	C2'-C2	3.80	1.56	1.50

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	204	LLP	C4-C4'-NZ	-4.26	104.38	124.04
1	A	204	LLP	CE-NZ-C4'	-4.18	105.34	118.72
1	A	204	LLP	C4-C4'-NZ	-3.01	110.15	124.04
1	B	204	LLP	CD-CE-NZ	-2.47	104.30	110.83
1	A	204	LLP	C5-C6-N1	-2.22	120.21	123.83

There are no chirality outliers.

5 of 14 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	204	LLP	C-CA-CB-CG
1	B	204	LLP	C5'-OP4-P-OP2
1	B	204	LLP	C5'-OP4-P-OP3
1	B	204	LLP	C4-C4'-NZ-CE
1	A	204	LLP	C4-C4'-NZ-CE

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	204	LLP	1	0
1	A	204	LLP	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides 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, 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	387/415 (93%)	-0.26	1 (0%) 90 81	46, 65, 96, 125	0
1	B	385/415 (92%)	-0.20	0 100 100	49, 84, 120, 153	0
All	All	772/830 (93%)	-0.23	1 (0%) 92 89	46, 73, 113, 153	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	386	ALA	2.2

6.2 Non-standard residues in protein, DNA, RNA chains [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. 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	B-factors(Å ²)	Q<0.9
1	LLP	A	204	24/25	0.91	0.13	55,85,91,94	0
1	LLP	B	204	24/25	0.91	0.12	60,99,106,108	0

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.