



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 03:56 AM UTC

PDB ID : 5I5J / pdb_00005i5j
Title : Shewanella denitrificans nitrous oxide reductase, reduced apo form
Authors : Schneider, L.K.; Einsle, O.
Deposited on : 2016-02-15
Resolution : 2.55 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

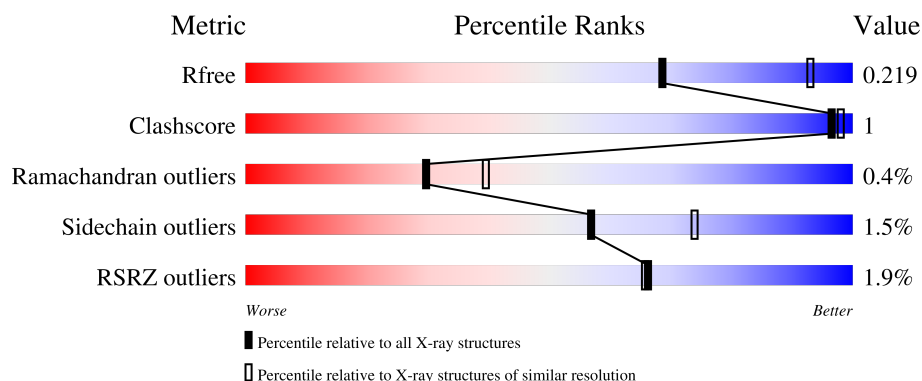
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.55 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	1091 (2.54-2.54)
Clashscore	190562	1120 (2.54-2.54)
Ramachandran outliers	187476	1106 (2.54-2.54)
Sidechain outliers	187428	1106 (2.54-2.54)
RSRZ outliers	180081	1091 (2.54-2.54)

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	636	
1	B	636	

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 8450 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 Nitrous-oxide reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	531	Total	C	N	O	S	0	2	0
			4193	2648	734	784	27			
1	B	529	Total	C	N	O	S	0	1	0
			4169	2635	728	779	27			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	629	LEU	-	expression tag	UNP Q12M27
A	630	GLU	-	expression tag	UNP Q12M27
A	631	HIS	-	expression tag	UNP Q12M27
A	632	HIS	-	expression tag	UNP Q12M27
A	633	HIS	-	expression tag	UNP Q12M27
A	634	HIS	-	expression tag	UNP Q12M27
A	635	HIS	-	expression tag	UNP Q12M27
A	636	HIS	-	expression tag	UNP Q12M27
B	629	LEU	-	expression tag	UNP Q12M27
B	630	GLU	-	expression tag	UNP Q12M27
B	631	HIS	-	expression tag	UNP Q12M27
B	632	HIS	-	expression tag	UNP Q12M27
B	633	HIS	-	expression tag	UNP Q12M27
B	634	HIS	-	expression tag	UNP Q12M27
B	635	HIS	-	expression tag	UNP Q12M27
B	636	HIS	-	expression tag	UNP Q12M27

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	59	Total	O	0	0
			59	59		
2	B	29	Total	O	0	0
			29	29		

4 Data and refinement statistics

Property	Value	Source
Space group	P 2 ₁ 2 ₁ 2 ₁	Depositor
Cell constants a, b, c, α , β , γ	57.10Å 121.46Å 172.40Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	99.29 – 2.55 99.29 – 2.55	Depositor EDS
% Data completeness (in resolution range)	100.0 (99.29-2.55) 100.0 (99.29-2.55)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.58 (at 2.55Å)	Xtriage
Refinement program	REFMAC 5.8.0123	Depositor
R, R_{free}	0.188 , 0.228 (Not available) , 0.219	Depositor DCC
R_{free} test set	1964 reflections (4.91%)	wwPDB-VP
Wilson B-factor (Å ²)	51.1	Xtriage
Anisotropy	0.431	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 18.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	8450	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.68% 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 [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	0.72	0/4293	0.83	1/5809 (0.0%)
1	B	0.69	0/4266	0.82	0/5773
All	All	0.71	0/8559	0.83	1/11582 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	252	TYR	N-CA-C	5.87	119.04	109.06

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	4193	0	4108	10	0
1	B	4169	0	4085	9	0
2	A	59	0	0	0	0
2	B	29	0	0	0	0
All	All	8450	0	8193	17	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 1.

All (17) 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:125:HIS:CD2	1:A:485:HIS:HB2	2.28	0.67
1:A:426[B]:HIS:CE1	1:A:486:ASP:OD1	2.53	0.62
1:B:426[B]:HIS:NE2	1:B:486:ASP:OD1	2.36	0.58
1:A:434:ASP:O	1:A:435:THR:C	2.57	0.47
1:A:419:HIS:HD2	1:A:463:GLN:HE22	1.63	0.46
1:A:235:LEU:HD23	1:A:251:CYS:HB2	1.98	0.46
1:B:235:LEU:HD23	1:B:251:CYS:HB2	1.97	0.46
1:B:434:ASP:O	1:B:435:THR:C	2.60	0.45
1:A:580:ASN:HD22	1:B:148:ASN:HA	1.83	0.44
1:A:148:ASN:HA	1:B:580:ASN:HD22	1.82	0.44
1:B:426[B]:HIS:CE1	1:B:486:ASP:OD1	2.71	0.43
1:B:125:HIS:ND1	1:B:485:HIS:HB2	2.35	0.42
1:A:371:PRO:HA	1:A:385:THR:O	2.20	0.41
1:A:575:GLY:HA3	1:A:610:ASN:OD1	2.20	0.41
1:B:371:PRO:HA	1:B:385:THR:O	2.21	0.41
1:B:149:SER:HA	1:B:173:ILE:HG12	2.02	0.41
1:A:545:ASN:OD1	1:A:545:ASN:N	2.53	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	523/636 (82%)	502 (96%)	19 (4%)	2 (0%)	30	39
1	B	520/636 (82%)	500 (96%)	18 (4%)	2 (0%)	30	39
All	All	1043/1272 (82%)	1002 (96%)	37 (4%)	4 (0%)	30	39

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	315	LYS
1	B	315	LYS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	334	LYS
1	B	334	LYS

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	460/541 (85%)	452 (98%)	8 (2%)	53	72
1	B	457/541 (84%)	451 (99%)	6 (1%)	61	76
All	All	917/1082 (85%)	903 (98%)	14 (2%)	57	74

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	238	THR
1	A	248	PHE
1	A	251	CYS
1	A	268	ARG
1	A	429	GLN
1	A	545	ASN
1	A	549	ASN
1	A	579	THR
1	B	238	THR
1	B	248	PHE
1	B	251	CYS
1	B	358	ARG
1	B	545	ASN
1	B	579	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	74	HIS
1	A	290	ASN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	419	HIS
1	A	429	GLN
1	A	461	ASN
1	A	476	HIS
1	A	545	ASN
1	A	590	GLN
1	B	59	HIS
1	B	128	HIS
1	B	171	GLN
1	B	332	ASN
1	B	461	ASN
1	B	549	ASN
1	B	580	ASN
1	B	590	GLN

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 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

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	531/636 (83%)	0.05	11 (2%) 63 64	19, 36, 58, 86	2 (0%)
1	B	529/636 (83%)	0.10	9 (1%) 69 69	20, 37, 57, 95	1 (0%)
All	All	1060/1272 (83%)	0.08	20 (1%) 66 66	19, 36, 59, 95	3 (0%)

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	611	TRP	4.1
1	B	543	ALA	3.8
1	A	293	GLY	3.7
1	A	543	ALA	3.2
1	A	193	PHE	2.8
1	A	611	TRP	2.8
1	B	572	VAL	2.6
1	B	406	GLY	2.5
1	B	193	PHE	2.4
1	B	252	TYR	2.3
1	B	608	TYR	2.3
1	A	557	ASP	2.3
1	B	212	ARG	2.2
1	A	524	MET	2.1
1	A	573	THR	2.1
1	A	409	VAL	2.1
1	A	572	VAL	2.1
1	A	610	ASN	2.1
1	A	571	ASP	2.1
1	B	610	ASN	2.0

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 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.