



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 01:28 AM UTC

PDB ID : 2DWT / pdb_00002dwt
Title : Cu-containing nitrite reductase at pH 6.0 with bound nitrite
Authors : Jacobson, F.
Deposited on : 2006-08-17
Resolution : 1.90 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
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

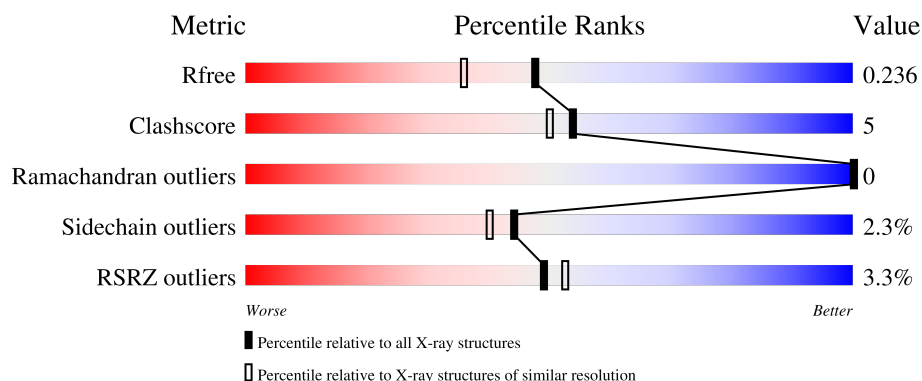
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

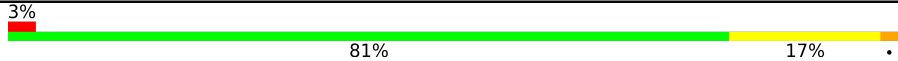
The reported resolution of this entry is 1.90 Å.

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	7789 (1.90-1.90)
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (1.90-1.90)

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	329	

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	NO2	A	501	-	-	X	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 2642 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 Copper-containing nitrite reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	329	Total	C	N	O	S	36	0	0
			2530	1615	432	470	13			

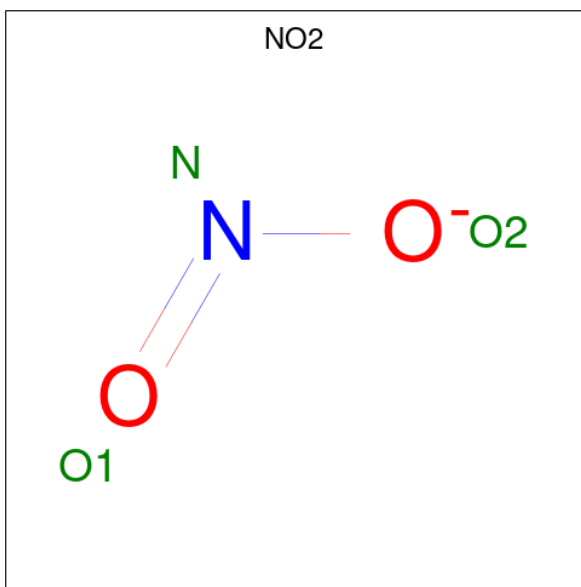
There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	230	ASP	THR	SEE REMARK 999	UNP Q53239
A	281	ASN	LYS	SEE REMARK 999	UNP Q53239
A	319	SER	THR	SEE REMARK 999	UNP Q53239
A	351	HIS	SER	SEE REMARK 999	UNP Q53239
A	367	VAL	TRP	SEE REMARK 999	UNP Q53239
A	368	ALA	PRO	SEE REMARK 999	UNP Q53239

- Molecule 2 is COPPER (II) ION (CCD ID: CU) (formula: Cu).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Cu	0	0
			2	2		

- Molecule 3 is NITRITE ION (CCD ID: NO2) (formula: NO₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	N	O	0	0
			3	1	2		
3	A	1	Total	N	O	0	0
			3	1	2		

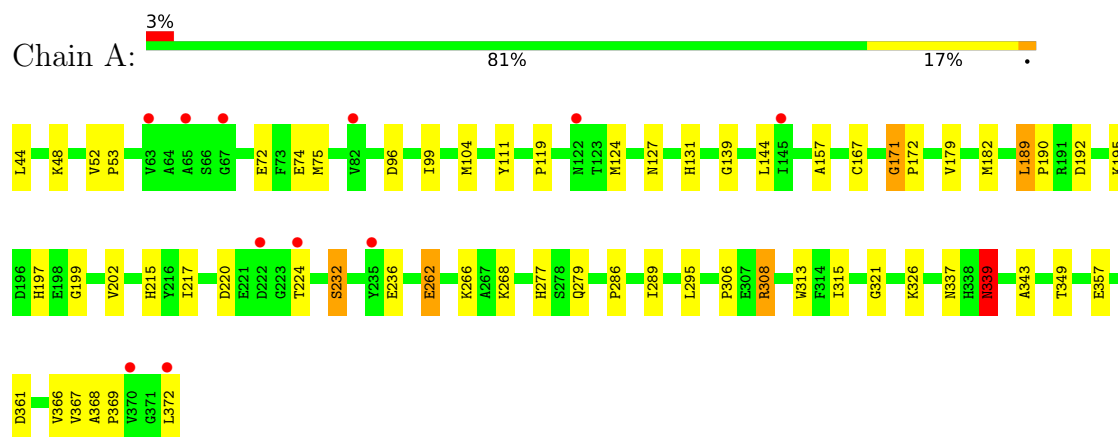
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	104	Total	O	0	0
			104	104		

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: Copper-containing nitrite reductase



4 Data and refinement statistics

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α , β , γ	74.74Å 74.74Å 153.15Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	24.71 – 1.90 24.71 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.2 (24.71-1.90) 99.2 (24.71-1.90)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.44 (at 1.90Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.199 , 0.235 0.200 , 0.236	Depositor DCC
R_{free} test set	1270 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	28.0	Xtriage
Anisotropy	0.421	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 41.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.033 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	2642	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.81% 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: CU, NO2

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	1.45	18/2603 (0.7%)	1.31	25/3546 (0.7%)

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	308	ARG	CD-NE	17.31	1.70	1.46
1	A	236	GLU	CD-OE2	-16.85	0.93	1.25
1	A	357	GLU	CD-OE1	-15.66	0.95	1.25
1	A	357	GLU	CD-OE2	-14.56	0.97	1.25
1	A	268	LYS	CE-NZ	13.86	1.91	1.49
1	A	266	LYS	CD-CE	13.25	1.92	1.52
1	A	236	GLU	CD-OE1	-12.40	1.01	1.25
1	A	48	LYS	CB-CG	-10.63	1.20	1.52
1	A	262	GLU	CB-CG	-9.55	1.23	1.52
1	A	74	GLU	CG-CD	8.57	1.73	1.52
1	A	315	ILE	CA-CB	6.74	1.61	1.53
1	A	321	GLY	N-CA	6.57	1.50	1.44
1	A	157	ALA	CA-CB	-5.96	1.45	1.52
1	A	99	ILE	N-CA	5.92	1.51	1.46
1	A	349	THR	N-CA	5.85	1.53	1.46
1	A	111	TYR	CA-C	-5.52	1.46	1.52
1	A	277	HIS	N-CA	5.27	1.52	1.46
1	A	53	PRO	CA-C	5.03	1.54	1.51

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	326	LYS	CD-CE-NZ	15.10	160.21	111.90
1	A	220	ASP	N-CA-CB	14.18	129.80	110.38
1	A	220	ASP	CA-CB-CG	11.78	124.38	112.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	74	GLU	CB-CG-CD	-10.36	94.98	112.60
1	A	262	GLU	CA-CB-CG	8.68	131.46	114.10
1	A	74	GLU	CG-CD-OE1	-8.23	99.47	118.40
1	A	74	GLU	CG-CD-OE2	7.96	136.71	118.40
1	A	266	LYS	CG-CD-CE	-7.47	94.13	111.30
1	A	131	HIS	N-CA-C	-7.21	104.46	113.18
1	A	139	GLY	N-CA-C	-6.78	105.70	114.85
1	A	44	LEU	CD1-CG-CD2	6.49	125.07	110.80
1	A	357	GLU	OE1-CD-OE2	6.44	138.36	122.90
1	A	339	ASN	N-CA-C	-6.21	97.06	107.99
1	A	308	ARG	CG-CD-NE	-6.19	98.37	112.00
1	A	217	ILE	CA-C-N	-6.05	114.53	120.52
1	A	217	ILE	C-N-CA	-6.05	114.53	120.52
1	A	119	PRO	CA-C-N	5.88	125.49	119.56
1	A	119	PRO	C-N-CA	5.88	125.49	119.56
1	A	189	LEU	CA-C-N	-5.79	113.82	119.78
1	A	189	LEU	C-N-CA	-5.79	113.82	119.78
1	A	171	GLY	CA-C-N	5.78	125.45	119.56
1	A	171	GLY	C-N-CA	5.78	125.45	119.56
1	A	96	ASP	N-CA-C	5.47	119.24	112.24
1	A	308	ARG	CD-NE-CZ	5.31	131.84	124.40
1	A	232	SER	N-CA-C	5.07	117.46	111.33

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	2530	0	2442	24	0
2	A	2	0	0	0	0
3	A	6	0	0	2	0
4	A	104	0	0	5	0
All	All	2642	0	2442	24	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 (24) 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:197:HIS:CE1	1:A:308:ARG:HD2	2.19	0.77
1:A:339:ASN:C	1:A:339:ASN:HD22	2.02	0.66
1:A:289:ILE:HG12	3:A:501:NO2:N	2.17	0.59
1:A:75:MET:HE2	1:A:104:MET:CE	2.34	0.58
1:A:224:THR:HG21	4:A:589:HOH:O	2.05	0.56
1:A:337:ASN:O	1:A:343:ALA:HB2	2.11	0.51
1:A:179:VAL:O	1:A:215:HIS:HD2	1.93	0.51
1:A:124:MET:HE1	1:A:232:SER:OG	2.11	0.50
1:A:167:CYS:HB2	1:A:182:MET:HG2	1.95	0.49
1:A:295:LEU:HD23	1:A:308:ARG:HG2	1.96	0.48
1:A:286:PRO:HG2	1:A:313:TRP:CD1	2.50	0.47
1:A:72:GLU:HG2	4:A:602:HOH:O	2.15	0.47
1:A:124:MET:CE	1:A:232:SER:OG	2.64	0.46
1:A:195:LYS:HD2	1:A:199:GLY:O	2.16	0.45
1:A:127:ASN:HB3	1:A:144:LEU:HA	1.98	0.44
1:A:52:VAL:HG22	4:A:516:HOH:O	2.16	0.44
1:A:361:ASP:O	4:A:558:HOH:O	2.21	0.44
1:A:289:ILE:CD1	3:A:501:NO2:N	2.81	0.43
1:A:366:VAL:HG12	1:A:367:VAL:HG23	2.00	0.42
1:A:224:THR:CG2	4:A:589:HOH:O	2.67	0.41
1:A:171:GLY:HA3	1:A:172:PRO:HD3	1.73	0.41
1:A:197:HIS:HA	1:A:306:PRO:HD2	2.02	0.41
1:A:189:LEU:O	1:A:190:PRO:C	2.61	0.40
1:A:368:ALA:HB1	1:A:369:PRO:HD2	2.03	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	327/329 (99%)	318 (97%)	9 (3%)	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	265/265 (100%)	259 (98%)	6 (2%)	44	40

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	192	ASP
1	A	202	VAL
1	A	262	GLU
1	A	279	GLN
1	A	339	ASN
1	A	372	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	83	GLN
1	A	215	HIS
1	A	339	ASN
1	A	365	GLN

5.3.3 RNA ⓘ

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](#)

Of 4 ligands modelled in this entry, 2 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	NO2	A	501	2	1,2,2	4.90	1 (100%)	0,1,1	-	-
3	NO2	A	502	-	1,2,2	5.01	1 (100%)	0,1,1	-	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	502	NO2	O1-N	5.01	1.47	1.22
3	A	501	NO2	O1-N	4.90	1.46	1.22

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	501	NO2	2	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](#)

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	329/329 (100%)	0.39	11 (3%) 49 52	17, 32, 47, 58	15 (4%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	65	ALA	3.1
1	A	67	GLY	3.1
1	A	122	ASN	2.7
1	A	235	TYR	2.6
1	A	145	ILE	2.5
1	A	372	LEU	2.4
1	A	63	VAL	2.2
1	A	224	THR	2.2
1	A	222	ASP	2.1
1	A	370	VAL	2.1
1	A	82	VAL	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](#)

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
3	NO2	A	502	3/3	0.81	0.11	56,56,57,57	0
3	NO2	A	501	3/3	0.97	0.11	33,33,39,40	0
2	CU	A	401	1/1	0.98	0.04	36,36,36,36	0
2	CU	A	402	1/1	1.00	0.01	27,27,27,27	0

6.5 Other polymers [i](#)

There are no such residues in this entry.