



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 08:08 PM UTC

PDB ID : 1V29 / pdb_00001v29
Title : Crystal structure of Nitrile hydratase from a thermophile *Bacillus smithii*
Authors : Hourai, S.; Miki, M.; Takashima, Y.; Mitsuda, S.; Yanagi, K.
Deposited on : 2003-10-09
Resolution : 2.60 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) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

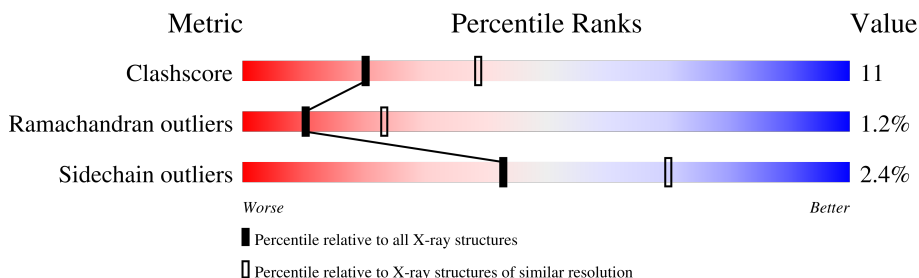
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.60 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))
Clashscore	190562	4347 (2.60-2.60)
Ramachandran outliers	187476	4277 (2.60-2.60)
Sidechain outliers	187428	4277 (2.60-2.60)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	220	
2	B	229	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3648 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 nitrile hydratase a chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	203	Total	C	N	O	S	0	0	0
			1644	1049	288	300	7			

- Molecule 2 is a protein called nitrile hydratase b chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	229	Total	C	N	O	S	0	0	0
			1884	1206	321	349	8			

- Molecule 3 is COBALT (II) ION (CCD ID: CO) (formula: Co).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Co	0	0
			1	1		

- Molecule 4 is water.

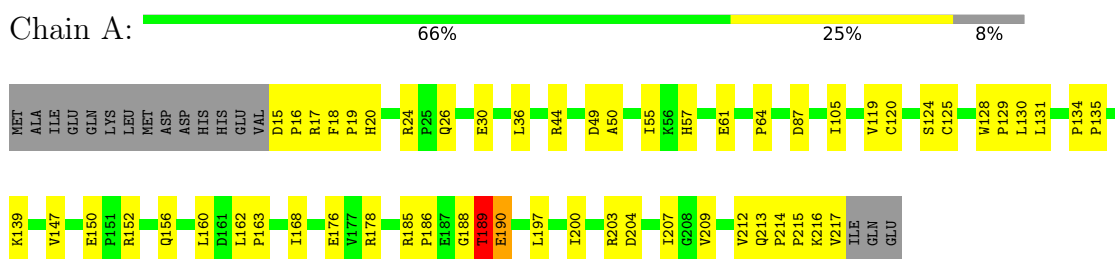
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	47	Total	O	0	0
			47	47		
4	B	72	Total	O	0	0
			72	72		

3 Residue-property plots

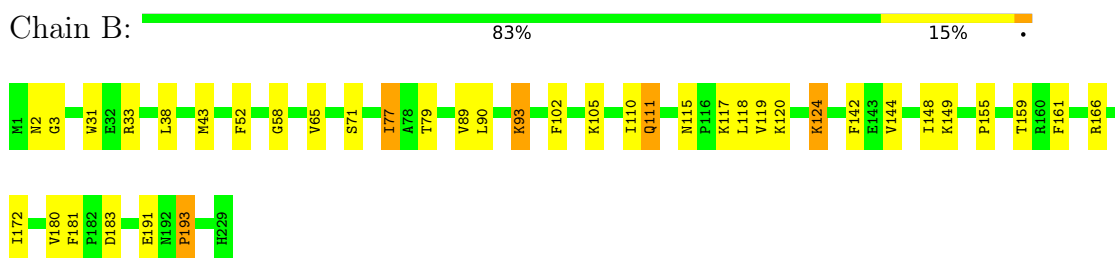
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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. 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.

Note EDS was not executed.

- Molecule 1: nitrile hydratase a chain



- Molecule 2: nitrile hydratase b chain



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, α , β , γ	158.42Å 158.42Å 126.77Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 2.60	Depositor
% Data completeness (in resolution range)	93.7 (15.00-2.60)	Depositor
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNX	Depositor
R, R_{free}	0.185 , 0.226	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3648	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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	0.42	0/1689	0.90	5/2297 (0.2%)
2	B	0.42	0/1935	0.82	2/2613 (0.1%)
All	All	0.42	0/3624	0.86	7/4910 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	105	LYS	CA-C-N	6.65	126.34	119.56
2	B	105	LYS	C-N-CA	6.65	126.34	119.56
1	A	207	ILE	N-CA-C	-5.58	106.89	113.42
1	A	87	ASP	CA-C-N	5.37	125.01	119.05
1	A	87	ASP	C-N-CA	5.37	125.01	119.05
1	A	24	ARG	CA-C-N	5.01	124.91	119.85
1	A	24	ARG	C-N-CA	5.01	124.91	119.85

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	1644	0	1631	48	0
2	B	1884	0	1818	38	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	1	0	0	0	0
4	A	47	0	0	0	0
4	B	72	0	0	3	0
All	All	3648	0	3449	79	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 11.

All (79) 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:134:PRO:HG2	1:A:139:LYS:HE2	1.63	0.80
1:A:17:ARG:HD3	1:A:17:ARG:H	1.50	0.77
2:B:102:PHE:HZ	2:B:110:ILE:HD11	1.52	0.74
2:B:43:MET:HE1	2:B:52:PHE:CE1	2.26	0.70
2:B:191:GLU:O	2:B:193:PRO:HD3	1.92	0.70
1:A:16:PRO:HD2	1:A:17:ARG:HH11	1.58	0.68
1:A:185:ARG:HE	1:A:189:THR:HG21	1.60	0.67
1:A:128:TRP:HB2	1:A:129:PRO:HD3	1.77	0.67
1:A:105:ILE:HD13	1:A:130:LEU:HD12	1.77	0.66
1:A:119:VAL:HG22	1:A:120:CYS:N	2.11	0.66
1:A:55:ILE:HD13	2:B:33:ARG:HB3	1.78	0.66
1:A:119:VAL:HG22	1:A:120:CYS:H	1.61	0.65
2:B:2:ASN:HD21	2:B:166:ARG:HH12	1.45	0.64
2:B:144:VAL:HA	2:B:172:ILE:HG22	1.81	0.61
2:B:124:LYS:NZ	2:B:124:LYS:HB2	2.15	0.61
1:A:186:PRO:O	1:A:189:THR:HG22	2.02	0.60
2:B:93:LYS:H	2:B:93:LYS:HD2	1.66	0.59
1:A:18:PHE:N	1:A:19:PRO:HD3	2.18	0.58
1:A:17:ARG:C	1:A:19:PRO:HD3	2.29	0.58
2:B:181:PHE:CE2	2:B:183:ASP:HB2	2.38	0.58
1:A:189:THR:O	1:A:190:GLU:HG2	2.05	0.56
1:A:152:ARG:O	1:A:156:GLN:HG3	2.07	0.54
1:A:16:PRO:HD2	1:A:17:ARG:NH1	2.24	0.53
1:A:185:ARG:HG2	1:A:189:THR:HG21	1.90	0.52
2:B:43:MET:HE1	2:B:52:PHE:CZ	2.45	0.52
2:B:180:VAL:HG13	2:B:191:GLU:HB2	1.89	0.52
1:A:189:THR:OG1	1:A:190:GLU:N	2.41	0.52
1:A:15:ASP:N	1:A:16:PRO:HD2	2.26	0.51
2:B:191:GLU:O	2:B:191:GLU:HG3	2.11	0.51
2:B:115:ASN:ND2	2:B:117:LYS:HB3	2.26	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:148:ILE:HG13	2:B:149:LYS:H	1.77	0.49
2:B:3:GLY:HA3	4:B:244:HOH:O	2.12	0.49
1:A:130:LEU:HB3	1:A:131:LEU:HD12	1.95	0.49
2:B:155:PRO:HG2	2:B:159:THR:HG21	1.95	0.49
1:A:152:ARG:HG3	1:A:168:ILE:HD12	1.94	0.48
1:A:213:GLN:HG3	1:A:214:PRO:HD2	1.95	0.48
2:B:142:PHE:CE2	2:B:148:ILE:HD11	2.48	0.48
2:B:93:LYS:HD2	2:B:93:LYS:N	2.28	0.47
1:A:20:HIS:O	2:B:65:VAL:HG11	2.15	0.47
2:B:161:PHE:CZ	2:B:166:ARG:HG2	2.50	0.47
1:A:125:CYS:HB3	1:A:178:ARG:CZ	2.45	0.47
2:B:148:ILE:HD12	2:B:148:ILE:HA	1.73	0.47
1:A:15:ASP:N	1:A:17:ARG:NH1	2.63	0.46
1:A:185:ARG:CG	1:A:189:THR:HG21	2.46	0.46
1:A:150:GLU:O	1:A:150:GLU:HG3	2.15	0.45
1:A:30:GLU:HG3	2:B:31:TRP:CD1	2.52	0.45
2:B:120:LYS:HA	2:B:120:LYS:HD2	1.66	0.45
1:A:216:LYS:HE3	1:A:217:VAL:HG23	1.98	0.44
1:A:185:ARG:HE	1:A:189:THR:CG2	2.29	0.44
1:A:64:PRO:HA	1:A:131:LEU:HA	2.00	0.44
1:A:50:ALA:HA	2:B:119:VAL:HG22	1.98	0.44
1:A:189:THR:HG23	1:A:190:GLU:H	1.82	0.44
1:A:214:PRO:HA	1:A:215:PRO:HD3	1.75	0.44
2:B:77:ILE:HD13	2:B:77:ILE:HA	1.77	0.44
2:B:111:GLN:O	2:B:111:GLN:HG3	2.19	0.43
2:B:58:GLY:HA3	2:B:79:THR:OG1	2.19	0.43
2:B:161:PHE:CE2	2:B:166:ARG:HG2	2.52	0.43
1:A:44:ARG:NH2	2:B:111:GLN:HE22	2.16	0.43
1:A:49:ASP:OD1	1:A:49:ASP:N	2.52	0.43
2:B:110:ILE:HD13	2:B:110:ILE:HA	1.87	0.43
1:A:197:LEU:O	1:A:200:ILE:HG12	2.18	0.43
1:A:204:ASP:HB3	1:A:209:VAL:HG23	2.01	0.43
1:A:26:GLN:HE22	2:B:71:SER:H	1.66	0.42
1:A:57:HIS:HE1	4:B:251:HOH:O	2.02	0.42
2:B:115:ASN:HD22	2:B:117:LYS:HB3	1.84	0.42
1:A:15:ASP:HB3	1:A:16:PRO:HD3	2.00	0.42
1:A:57:HIS:HA	1:A:61:GLU:HB2	2.01	0.42
2:B:180:VAL:HG13	2:B:191:GLU:CB	2.50	0.42
1:A:189:THR:O	1:A:190:GLU:O	2.38	0.41
2:B:89:VAL:O	2:B:90:LEU:HD23	2.20	0.41
1:A:186:PRO:HG2	1:A:212:VAL:HG12	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:124:LYS:HB2	2:B:124:LYS:HZ3	1.84	0.41
1:A:135:PRO:HG3	1:A:203:ARG:CZ	2.50	0.41
1:A:162:LEU:HA	1:A:163:PRO:HD3	1.88	0.41
2:B:2:ASN:ND2	4:B:234:HOH:O	2.54	0.41
2:B:115:ASN:HD21	2:B:118:LEU:HG	1.86	0.41
1:A:176:GLU:HA	1:A:176:GLU:OE2	2.21	0.40
1:A:44:ARG:HH21	2:B:111:GLN:HE22	1.68	0.40
1:A:216:LYS:HB3	1:A:216:LYS:HE2	1.89	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	201/220 (91%)	191 (95%)	6 (3%)	4 (2%)	6	12
2	B	227/229 (99%)	217 (96%)	9 (4%)	1 (0%)	30	51
All	All	428/449 (95%)	408 (95%)	15 (4%)	5 (1%)	10	23

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	124	SER
1	A	189	THR
1	A	190	GLU
1	A	188	GLY
2	B	193	PRO

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	183/199 (92%)	179 (98%)	4 (2%)	45	72
2	B	198/198 (100%)	193 (98%)	5 (2%)	42	69
All	All	381/397 (96%)	372 (98%)	9 (2%)	43	70

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	36	LEU
1	A	147	VAL
1	A	160	LEU
1	A	189	THR
2	B	38	LEU
2	B	77	ILE
2	B	93	LYS
2	B	111	GLN
2	B	124	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	22	HIS
1	A	26	GLN
1	A	57	HIS
1	A	184	GLN
2	B	2	ASN
2	B	45	GLN
2	B	211	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 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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 ⓘ

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates ⓘ

EDS was not executed - this section is therefore empty.

6.4 Ligands ⓘ

EDS was not executed - this section is therefore empty.

6.5 Other polymers ⓘ

EDS was not executed - this section is therefore empty.