



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 05:47 PM UTC

PDB ID : 2OHE / pdb_00002ohe
Title : Structural and mutational analysis of tRNA-Intron splicing endonuclease from Thermoplasma acidophilum DSM 1728
Authors : Kim, Y.K.; Mizutani, K.; Rhee, K.H.; Lee, W.H.; Park, S.Y.; Hwang, K.Y.
Deposited on : 2007-01-10
Resolution : 2.70 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

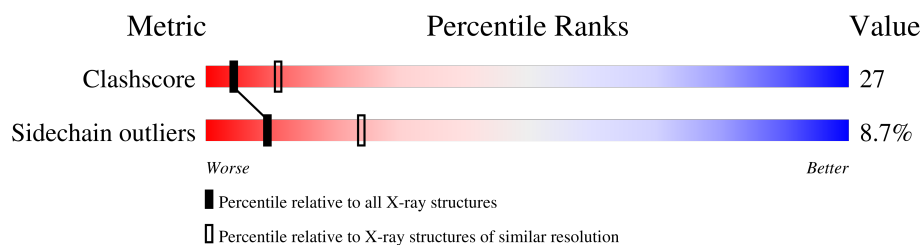
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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	3843 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)

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	290	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2472 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 tRNA-splicing endonuclease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	290	Total	C	N	O	S	0	0	0
			2356	1510	399	438	9			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	HIS	-	expression tag	UNP Q9HIY5
A	146	GLY	ALA	conflict	UNP Q9HIY5

- Molecule 2 is water.

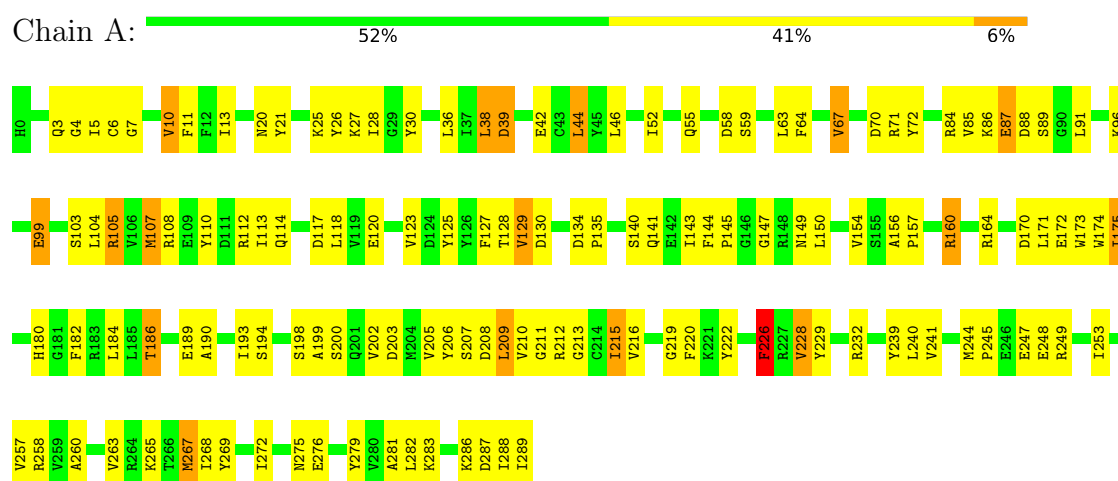
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	116	Total	O	0	0
			116	116		

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: tRNA-splicing endonuclease



4 Data and refinement statistics

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

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	164.91Å 46.09Å 58.00Å 90.00° 92.61° 90.00°	Depositor
Resolution (Å)	17.79 – 2.70	Depositor
% Data completeness (in resolution range)	81.8 (17.79-2.70)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.214 , 0.278	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2472	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

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	0.49	0/2413	0.92	7/3255 (0.2%)

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	1

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	186	THR	N-CA-C	-6.83	99.83	110.42
1	A	120	GLU	N-CA-C	-6.29	105.46	112.57
1	A	25	LYS	N-CA-C	5.82	117.71	111.36
1	A	216	VAL	N-CA-C	5.70	116.31	107.99
1	A	21	TYR	N-CA-C	-5.46	105.23	111.07
1	A	226	PHE	N-CA-C	5.29	116.88	108.79
1	A	67	VAL	N-CA-C	-5.11	101.04	108.97

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	72	TYR	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	2356	0	2297	125	0
2	A	116	0	0	7	0
All	All	2472	0	2297	125	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 27.

All (125) 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:228:VAL:HG22	1:A:239:TYR:HB2	1.51	0.89
1:A:105:ARG:HE	1:A:107:MET:HE1	1.42	0.85
1:A:215:ILE:HG23	1:A:229:TYR:HB2	1.60	0.83
1:A:141:GLN:HB2	2:A:341:HOH:O	1.78	0.82
1:A:200:SER:HB3	1:A:203:ASP:OD1	1.79	0.82
1:A:10:VAL:HG22	1:A:55:GLN:HB2	1.59	0.81
1:A:172:GLU:HB2	1:A:175:ILE:HG22	1.63	0.80
1:A:71:ARG:HD2	2:A:336:HOH:O	1.83	0.78
1:A:99:GLU:H	1:A:99:GLU:CD	1.94	0.75
1:A:3:GLN:HB2	1:A:11:PHE:O	1.89	0.72
1:A:215:ILE:CG2	1:A:229:TYR:HB2	2.20	0.71
1:A:4:GLY:HA2	1:A:36:LEU:H	1.56	0.70
1:A:113:ILE:HG21	1:A:253:ILE:HD13	1.72	0.70
1:A:206:TYR:O	1:A:210:VAL:HG23	1.92	0.68
1:A:110:TYR:HB2	2:A:378:HOH:O	1.94	0.66
1:A:171:LEU:O	1:A:172:GLU:C	2.38	0.66
1:A:143:ILE:HD11	1:A:239:TYR:OH	1.95	0.66
1:A:286:LYS:HG3	1:A:287:ASP:N	2.11	0.66
1:A:220:PHE:HB3	2:A:383:HOH:O	1.96	0.65
1:A:288:ILE:O	1:A:289:ILE:HB	1.98	0.64
1:A:220:PHE:C	1:A:222:TYR:H	2.05	0.64
1:A:172:GLU:HB2	1:A:175:ILE:CG2	2.28	0.64
1:A:219:GLY:N	1:A:226:PHE:HA	2.13	0.64
1:A:147:GLY:HA3	1:A:213:GLY:C	2.24	0.62
1:A:70:ASP:HB2	1:A:108:ARG:HH21	1.65	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:39:ASP:C	1:A:39:ASP:OD2	2.43	0.61
1:A:87:GLU:H	1:A:87:GLU:CD	2.09	0.60
1:A:202:VAL:HG13	2:A:316:HOH:O	1.99	0.60
1:A:269:TYR:HD2	1:A:282:LEU:HD13	1.66	0.60
1:A:228:VAL:CG2	1:A:239:TYR:HB2	2.28	0.60
1:A:85:VAL:HG12	1:A:86:LYS:N	2.17	0.59
1:A:105:ARG:HE	1:A:107:MET:CE	2.14	0.59
1:A:114:GLN:HB3	1:A:117:ASP:OD2	2.03	0.59
1:A:145:PRO:HG2	1:A:212:ARG:HD3	1.86	0.58
1:A:104:LEU:HD21	1:A:127:PHE:HB2	1.85	0.58
1:A:70:ASP:HA	1:A:129:VAL:HG11	1.87	0.56
1:A:13:ILE:HA	1:A:52:ILE:HG22	1.86	0.56
1:A:4:GLY:C	1:A:5:ILE:HG13	2.30	0.56
1:A:172:GLU:CB	1:A:175:ILE:HG22	2.35	0.56
1:A:11:PHE:CZ	1:A:38:LEU:HD22	2.42	0.54
1:A:232:ARG:HG3	1:A:232:ARG:HH11	1.72	0.54
1:A:263:VAL:O	1:A:263:VAL:HG12	2.06	0.54
1:A:160:ARG:HD3	1:A:164:ARG:O	2.07	0.54
1:A:149:ASN:HB2	1:A:213:GLY:O	2.08	0.53
1:A:26:TYR:O	1:A:28:ILE:HG23	2.10	0.52
1:A:174:TRP:CE3	1:A:215:ILE:HG13	2.45	0.52
1:A:232:ARG:HG3	1:A:232:ARG:NH1	2.25	0.52
1:A:143:ILE:HG23	1:A:279:TYR:HB2	1.92	0.51
1:A:219:GLY:H	1:A:226:PHE:HA	1.74	0.51
1:A:20:ASN:ND2	2:A:325:HOH:O	2.36	0.51
1:A:222:TYR:CE2	1:A:263:VAL:HG21	2.45	0.51
1:A:27:LYS:HG3	1:A:84:ARG:NH2	2.26	0.51
1:A:220:PHE:C	1:A:222:TYR:N	2.69	0.50
1:A:64:PHE:O	1:A:67:VAL:O	2.28	0.50
1:A:143:ILE:CG2	1:A:279:TYR:HB2	2.41	0.50
1:A:286:LYS:CG	1:A:287:ASP:N	2.75	0.50
1:A:240:LEU:HB3	1:A:267:MET:HE2	1.94	0.49
1:A:96:LYS:HB3	1:A:99:GLU:OE1	2.12	0.49
1:A:39:ASP:OD2	1:A:42:GLU:HG3	2.12	0.48
1:A:113:ILE:HG23	1:A:248:GLU:HB3	1.95	0.48
1:A:113:ILE:HD11	1:A:118:LEU:HD21	1.94	0.48
1:A:28:ILE:HD12	1:A:42:GLU:HB3	1.96	0.48
1:A:172:GLU:O	1:A:173:TRP:C	2.56	0.48
1:A:240:LEU:HD12	1:A:240:LEU:HA	1.70	0.48
1:A:258:ARG:C	1:A:260:ALA:H	2.21	0.48
1:A:87:GLU:CD	1:A:87:GLU:N	2.73	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:103:SER:OG	1:A:123:VAL:HA	2.13	0.47
1:A:104:LEU:HD11	1:A:127:PHE:CB	2.44	0.47
1:A:113:ILE:HD12	1:A:114:GLN:H	1.78	0.47
1:A:286:LYS:O	1:A:287:ASP:C	2.57	0.47
1:A:30:TYR:O	1:A:36:LEU:HD12	2.15	0.47
1:A:105:ARG:NE	1:A:107:MET:HE1	2.21	0.47
1:A:87:GLU:O	1:A:88:ASP:HB2	2.15	0.47
1:A:263:VAL:CG1	1:A:265:LYS:HE2	2.45	0.47
1:A:140:SER:HA	1:A:281:ALA:O	2.14	0.47
1:A:125:TYR:CE2	1:A:288:ILE:HG13	2.50	0.47
1:A:190:ALA:O	1:A:194:SER:CB	2.63	0.47
1:A:172:GLU:O	1:A:175:ILE:HG22	2.14	0.46
1:A:88:ASP:O	1:A:89:SER:HB3	2.15	0.46
1:A:104:LEU:CD2	1:A:127:PHE:HB2	2.45	0.46
1:A:38:LEU:HD21	1:A:46:LEU:HD12	1.97	0.46
1:A:186:THR:OG1	1:A:189:GLU:HG3	2.16	0.46
1:A:6:CYS:O	1:A:7:GLY:C	2.59	0.46
1:A:258:ARG:C	1:A:260:ALA:N	2.72	0.46
1:A:170:ASP:O	1:A:171:LEU:C	2.59	0.45
1:A:113:ILE:HG21	1:A:253:ILE:CD1	2.42	0.45
1:A:143:ILE:HG12	1:A:144:PHE:N	2.30	0.45
1:A:113:ILE:O	1:A:248:GLU:HB3	2.17	0.45
1:A:104:LEU:HD11	1:A:127:PHE:HB2	1.99	0.45
1:A:207:SER:O	1:A:208:ASP:C	2.60	0.44
1:A:209:LEU:HD12	1:A:209:LEU:HA	1.84	0.44
1:A:6:CYS:O	1:A:7:GLY:O	2.34	0.44
1:A:272:ILE:HA	1:A:276:GLU:O	2.18	0.44
1:A:164:ARG:NH1	1:A:184:LEU:HD21	2.33	0.44
1:A:156:ALA:HB1	1:A:157:PRO:CD	2.48	0.43
1:A:150:LEU:HD12	1:A:150:LEU:H	1.84	0.43
1:A:154:VAL:CG2	1:A:193:ILE:HG22	2.48	0.43
1:A:110:TYR:O	1:A:249:ARG:NH1	2.51	0.43
1:A:241:VAL:HG22	1:A:268:ILE:HB	1.99	0.43
1:A:205:VAL:O	1:A:209:LEU:HB2	2.18	0.43
1:A:253:ILE:O	1:A:257:VAL:HG23	2.19	0.43
1:A:286:LYS:HG3	1:A:287:ASP:H	1.84	0.42
1:A:58:ASP:O	1:A:59:SER:C	2.62	0.42
1:A:202:VAL:O	1:A:205:VAL:HG12	2.19	0.42
1:A:211:GLY:HA3	2:A:400:HOH:O	2.19	0.42
1:A:244:MET:HA	1:A:245:PRO:HD2	1.89	0.42
1:A:85:VAL:CG1	1:A:86:LYS:N	2.82	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:222:TYR:HB3	1:A:240:LEU:HD21	2.02	0.42
1:A:134:ASP:OD1	1:A:135:PRO:HD2	2.20	0.42
1:A:287:ASP:O	1:A:289:ILE:N	2.53	0.41
1:A:44:LEU:HD21	1:A:64:PHE:HA	2.02	0.41
1:A:91:LEU:HD21	1:A:123:VAL:HG11	2.03	0.41
1:A:244:MET:HE3	1:A:269:TYR:HB3	2.02	0.41
1:A:4:GLY:HA3	1:A:36:LEU:HB3	2.02	0.41
1:A:180:HIS:O	1:A:182:PHE:HD1	2.04	0.41
1:A:91:LEU:HD21	1:A:123:VAL:CG1	2.51	0.41
1:A:263:VAL:HG11	1:A:265:LYS:HE2	2.02	0.41
1:A:38:LEU:HD12	1:A:38:LEU:HA	1.91	0.41
1:A:130:ASP:OD1	1:A:134:ASP:HB3	2.21	0.41
1:A:156:ALA:HB3	1:A:193:ILE:HD12	2.03	0.40
1:A:202:VAL:HA	1:A:205:VAL:HG12	2.03	0.40
1:A:170:ASP:O	1:A:171:LEU:O	2.39	0.40
1:A:198:SER:O	1:A:199:ALA:C	2.65	0.40
1:A:4:GLY:CA	1:A:36:LEU:H	2.31	0.40
1:A:202:VAL:C	1:A:205:VAL:HG12	2.46	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

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	253/253 (100%)	231 (91%)	22 (9%)	9 24

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	VAL
1	A	38	LEU
1	A	39	ASP
1	A	44	LEU
1	A	63	LEU
1	A	87	GLU
1	A	99	GLU
1	A	105	ARG
1	A	107	MET
1	A	112	ARG
1	A	128	THR
1	A	129	VAL
1	A	160	ARG
1	A	175	ILE
1	A	209	LEU
1	A	215	ILE
1	A	226	PHE
1	A	228	VAL
1	A	247	GLU
1	A	267	MET
1	A	275	ASN
1	A	283	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	0	HIS
1	A	3	GLN
1	A	35	ASN
1	A	55	GLN
1	A	56	ASN
1	A	114	GLN
1	A	121	ASN
1	A	196	ASN
1	A	236	HIS
1	A	275	ASN

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](#)

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

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.