



# Full wwPDB X-ray Structure Validation Report ⓘ

May 28, 2020 – 08:02 pm BST

PDB ID : 1MJ5  
Title : LINB (haloalkane dehalogenase) from sphingomonas paucimobilis UT26 at atomic resolution  
Authors : Oakley, A.J.; Damborsky, J.; Wilce, M.C.  
Deposited on : 2002-08-27  
Resolution : 0.95 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](mailto: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.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

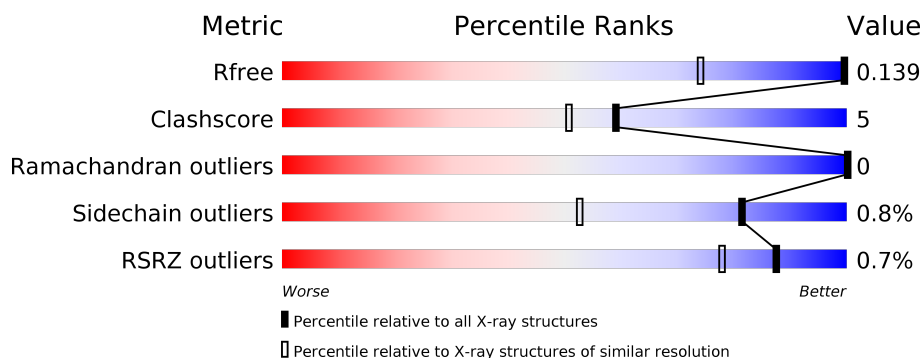
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 0.95 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))
$R_{free}$	130704	1243 (1.06-0.86)
Clashscore	141614	1321 (1.06-0.86)
Ramachandran outliers	138981	1233 (1.06-0.86)
Sidechain outliers	138945	1235 (1.06-0.86)
RSRZ outliers	127900	1209 (1.06-0.86)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	302	<div> <div></div> <div>86%</div> <div>12%</div> <div>..</div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5802 atoms, of which 2524 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 1,3,4,6-tetrachloro-1,4-cyclohexadiene hydrolase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	298	Total	C	H	N	O	S	13	54	1
			5139	1652	2524	466	485	12			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	297	HIS	-	EXPRESSION TAG	UNP P51698
A	298	HIS	-	EXPRESSION TAG	UNP P51698
A	299	HIS	-	EXPRESSION TAG	UNP P51698
A	300	HIS	-	EXPRESSION TAG	UNP P51698
A	301	HIS	-	EXPRESSION TAG	UNP P51698
A	302	HIS	-	EXPRESSION TAG	UNP P51698

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	3	Total	Mg	0	0
			3	3		

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Cl	0	0
			2	2		

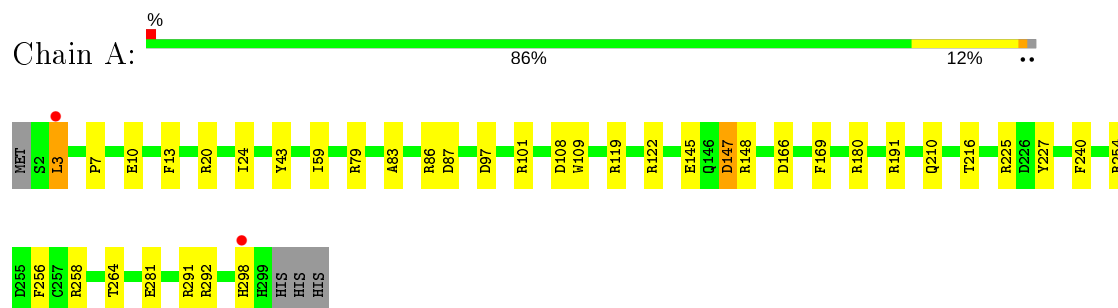
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	658	Total	O	0	159
			658	658		

### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: 1,3,4,6-tetrachloro-1,4-cyclohexadiene hydrolase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	46.39Å 68.38Å 80.72Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	22.76 – 0.95 22.74 – 0.95	Depositor EDS
% Data completeness (in resolution range)	(Not available) (22.76-0.95) 83.4 (22.74-0.95)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.78 (at 0.95Å)	Xtriage
Refinement program	SHELXL-97	Depositor
R, $R_{free}$	0.112 , 0.141 0.111 , 0.139	Depositor DCC
$R_{free}$ test set	6762 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	5.4	Xtriage
Anisotropy	0.408	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 71.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.99	EDS
Total number of atoms	5802	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	10.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.95% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: MG, CL

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	1.01	4/2701 (0.1%)	1.67	56/3666 (1.5%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	281	GLU	CD-OE1	6.62	1.32	1.25
1	A	145	GLU	CD-OE1	5.61	1.31	1.25
1	A	3	LEU	C-O	5.52	1.33	1.23
1	A	145	GLU	CD-OE2	5.14	1.31	1.25

All (56) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	225	ARG	NE-CZ-NH1	22.07	131.34	120.30
1	A	225	ARG	NE-CZ-NH2	-18.04	111.28	120.30
1	A	122	ARG	NE-CZ-NH2	-15.79	112.40	120.30
1	A	292[A]	ARG	NE-CZ-NH1	-15.23	112.68	120.30
1	A	292[B]	ARG	NE-CZ-NH1	-15.23	112.68	120.30
1	A	147[A]	ASP	CB-CG-OD1	15.20	131.98	118.30
1	A	147[B]	ASP	CB-CG-OD1	15.20	131.98	118.30
1	A	20[A]	ARG	NE-CZ-NH1	-14.50	113.05	120.30
1	A	20[B]	ARG	NE-CZ-NH1	-14.50	113.05	120.30
1	A	291	ARG	NE-CZ-NH2	-13.10	113.75	120.30
1	A	291	ARG	CD-NE-CZ	12.04	140.45	123.60
1	A	291	ARG	NE-CZ-NH1	11.21	125.91	120.30
1	A	292[A]	ARG	NE-CZ-NH2	9.50	125.05	120.30
1	A	292[B]	ARG	NE-CZ-NH2	9.50	125.05	120.30
1	A	258	ARG	NE-CZ-NH1	9.41	125.00	120.30
1	A	166[A]	ASP	CB-CG-OD2	-9.11	110.10	118.30
1	A	166[B]	ASP	CB-CG-OD2	-9.11	110.10	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	79	ARG	NE-CZ-NH2	-8.19	116.21	120.30
1	A	97	ASP	CB-CG-OD1	7.76	125.29	118.30
1	A	148[A]	ARG	NE-CZ-NH2	-7.75	116.43	120.30
1	A	86	ARG	NE-CZ-NH2	-7.72	116.44	120.30
1	A	180	ARG	NE-CZ-NH1	7.68	124.14	120.30
1	A	20[A]	ARG	NH1-CZ-NH2	7.57	127.72	119.40
1	A	20[B]	ARG	NH1-CZ-NH2	7.57	127.72	119.40
1	A	3	LEU	CB-CA-C	7.43	124.33	110.20
1	A	122	ARG	NH1-CZ-NH2	7.28	127.41	119.40
1	A	20[A]	ARG	CD-NE-CZ	7.20	133.69	123.60
1	A	20[B]	ARG	CD-NE-CZ	7.20	133.69	123.60
1	A	180	ARG	NE-CZ-NH2	-7.19	116.71	120.30
1	A	147[A]	ASP	OD1-CG-OD2	-7.10	109.80	123.30
1	A	147[B]	ASP	OD1-CG-OD2	-7.10	109.80	123.30
1	A	147[A]	ASP	CB-CA-C	7.03	124.46	110.40
1	A	147[B]	ASP	CB-CA-C	7.03	124.46	110.40
1	A	101	ARG	NE-CZ-NH1	6.98	123.79	120.30
1	A	281	GLU	OE1-CD-OE2	-6.35	115.69	123.30
1	A	148[A]	ARG	NH1-CZ-NH2	6.19	126.21	119.40
1	A	292[A]	ARG	CG-CD-NE	6.18	124.77	111.80
1	A	292[B]	ARG	CG-CD-NE	6.18	124.77	111.80
1	A	240	PHE	CB-CG-CD2	-6.14	116.50	120.80
1	A	97	ASP	CB-CG-OD2	-6.13	112.79	118.30
1	A	43	TYR	CB-CG-CD2	6.03	124.62	121.00
1	A	13[A]	PHE	CD1-CE1-CZ	-5.99	112.91	120.10
1	A	13[B]	PHE	CD1-CE1-CZ	-5.99	112.91	120.10
1	A	108[A]	ASP	CA-CB-CG	5.94	126.47	113.40
1	A	108[B]	ASP	CA-CB-CG	5.94	126.47	113.40
1	A	101	ARG	NE-CZ-NH2	-5.89	117.35	120.30
1	A	148[A]	ARG	NE-CZ-NH1	-5.88	117.36	120.30
1	A	254	ARG	NE-CZ-NH1	5.80	123.20	120.30
1	A	298	HIS	O-C-N	-5.58	113.77	122.70
1	A	119	ARG	NE-CZ-NH1	5.40	123.00	120.30
1	A	43	TYR	CG-CD2-CE2	5.37	125.59	121.30
1	A	145	GLU	CB-CG-CD	5.26	128.39	114.20
1	A	256	PHE	CB-CG-CD1	-5.12	117.21	120.80
1	A	227	TYR	CA-CB-CG	5.12	123.12	113.40
1	A	147[A]	ASP	CA-CB-CG	5.02	124.45	113.40
1	A	147[B]	ASP	CA-CB-CG	5.02	124.45	113.40

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	2615	2524	2344	23	0
2	A	3	0	0	0	0
3	A	2	0	0	0	0
4	A	658	0	0	13	0
All	All	3278	2524	2344	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:191[B]:ARG:NH1	4:A:3260:HOH:O	2.06	0.88
1:A:210[B]:GLN:NE2	4:A:3177:HOH:O	2.29	0.64
1:A:147[B]:ASP:HB3	4:A:3550[B]:HOH:O	2.02	0.58
1:A:191[B]:ARG:CG	4:A:3096:HOH:O	2.56	0.53
1:A:83:ALA:O	1:A:87[B]:ASP:OD2	2.26	0.52
1:A:191[B]:ARG:HD3	4:A:3331:HOH:O	2.08	0.52
1:A:264[A]:THR:CG2	4:A:3654:HOH:O	2.57	0.51
1:A:10[B]:GLU:N	4:A:3137:HOH:O	2.43	0.51
1:A:191[B]:ARG:HG3	4:A:3096:HOH:O	2.12	0.49
1:A:264[A]:THR:HG23	4:A:3654:HOH:O	2.14	0.47
1:A:7[B]:PRO:HG3	4:A:3200:HOH:O	2.17	0.45
1:A:191[B]:ARG:HG2	4:A:3096:HOH:O	2.17	0.44
1:A:216[B]:THR:HB	4:A:3216:HOH:O	2.16	0.44
1:A:109:TRP:CZ2	1:A:210[B]:GLN:HB2	2.53	0.44
1:A:24[B]:ILE:O	1:A:59:ILE:HA	2.21	0.41

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	329/302 (109%)	317 (96%)	12 (4%)	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	269/242 (111%)	267 (99%)	2 (1%)	84	56

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	LEU
1	A	169[A]	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 5 ligands modelled in this entry, 5 are 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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	147[B]:ASP	C	148:ARG	N	1.78

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	298/302 (98%)	-0.80	2 (0%) 87 78	3, 6, 14, 66	2 (0%)

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	298	HIS	3.6
1	A	3	LEU	2.2

### 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 carbohydrates 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
2	MG	A	2001	1/1	1.00	0.02	6,6,6,6	0
3	CL	A	2005	1/1	1.00	0.02	8,8,8,8	0
2	MG	A	2003	1/1	1.00	0.09	9,9,9,9	0
2	MG	A	2002	1/1	1.00	0.07	8,8,8,8	0
3	CL	A	2004	1/1	1.00	0.01	5,5,5,5	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.