



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 20, 2020 – 07:14 PM BST

PDB ID : 5CML
Title : Crystal structure of the Esterase domain from *Rhodothermus marinus* Rmar_1206 protein
Authors : Marles-Wright, J.; Wardrope, C.; Jensen, M.-B.V.; Horsfall, L.E.; Togneri, P.D.; Rosser, S.J.
Deposited on : 2015-07-16
Resolution : 1.56 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.13.1
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) : 2.13.1

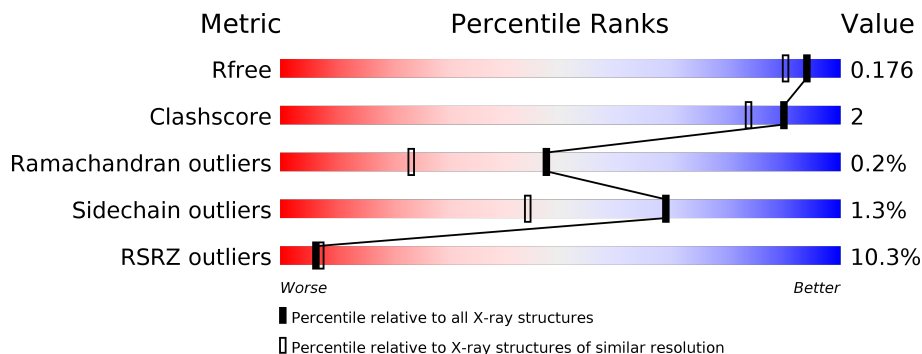
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.56 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	1483 (1.56-1.56)
Clashscore	141614	1529 (1.56-1.56)
Ramachandran outliers	138981	1498 (1.56-1.56)
Sidechain outliers	138945	1495 (1.56-1.56)
RSRZ outliers	127900	1465 (1.56-1.56)

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 ≥ 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	263	
1	B	263	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 7578 atoms, of which 3664 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 OsmC family protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	240	3732	1180	1872	335	336	9	0	3	0
1	B	226	3518	1115	1764	318	314	7	0	3	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	256	LEU	-	expression tag	UNP D0MHY8
A	257	GLY	-	expression tag	UNP D0MHY8
A	258	HIS	-	expression tag	UNP D0MHY8
A	259	HIS	-	expression tag	UNP D0MHY8
A	260	HIS	-	expression tag	UNP D0MHY8
A	261	HIS	-	expression tag	UNP D0MHY8
A	262	HIS	-	expression tag	UNP D0MHY8
A	263	HIS	-	expression tag	UNP D0MHY8
B	256	LEU	-	expression tag	UNP D0MHY8
B	257	GLY	-	expression tag	UNP D0MHY8
B	258	HIS	-	expression tag	UNP D0MHY8
B	259	HIS	-	expression tag	UNP D0MHY8
B	260	HIS	-	expression tag	UNP D0MHY8
B	261	HIS	-	expression tag	UNP D0MHY8
B	262	HIS	-	expression tag	UNP D0MHY8
B	263	HIS	-	expression tag	UNP D0MHY8

- Molecule 2 is TRIETHYLENE GLYCOL (three-letter code: PGE) (formula: C₆H₁₄O₄).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
2	A	1	24	6	14	4	0	0
2	B	1	24	6	14	4	0	0

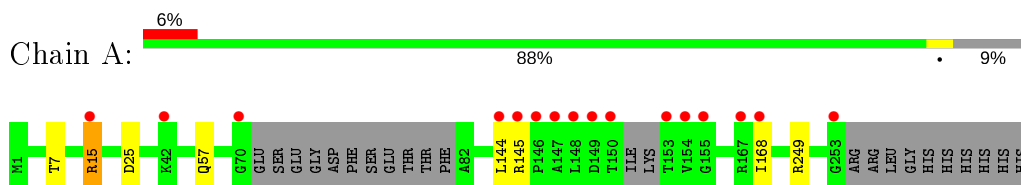
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	169	169	169	0	0
3	B	111	111	111	0	0

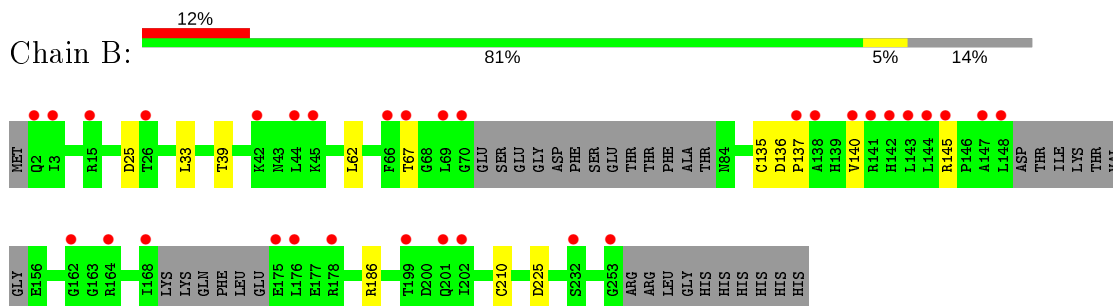
3 Residue-property plots [i](#)

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: OsmC family protein



- Molecule 1: OsmC family protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	60.33Å 74.07Å 60.95Å 90.00° 113.47° 90.00°	Depositor
Resolution (Å)	44.62 – 1.56 44.62 – 1.56	Depositor EDS
% Data completeness (in resolution range)	99.1 (44.62-1.56) 99.1 (44.62-1.56)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.26 (at 1.55Å)	Xtrriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.144 , 0.176 0.144 , 0.176	Depositor DCC
R_{free} test set	3544 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	23.3	Xtrriage
Anisotropy	0.601	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.42 , 47.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.024 for l,-k,h	Xtrriage
F_o, F_c correlation	0.98	EDS
Total number of atoms	7578	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.99% 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](#)

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

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	0/1905	0.62	0/2585
1	B	0.43	0/1797	0.60	0/2439
All	All	0.46	0/3702	0.61	0/5024

There are no bond length outliers.

There are no bond angle outliers.

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	1860	1872	1872	4	0
1	B	1754	1764	1763	9	0
2	A	10	14	14	0	0
2	B	10	14	14	0	0
3	A	169	0	0	0	0
3	B	111	0	0	1	0
All	All	3914	3664	3663	13	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 2.

All (13) 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:57:GLN:O	1:A:249:ARG:NH2	2.26	0.68
1:B:136:ASP:O	1:B:140:VAL:HG13	2.13	0.48
1:A:7:THR:HG22	1:A:15:ARG:HD2	1.95	0.48
1:B:136:ASP:HB2	1:B:137:PRO:CD	2.45	0.46
1:B:136:ASP:HB2	1:B:137:PRO:HD2	1.96	0.46
1:A:7:THR:CG2	1:A:15:ARG:HG3	2.46	0.46
1:B:135[B]:CYS:HB2	1:B:210:CYS:SG	2.57	0.45
1:B:33[B]:LEU:HD23	1:B:62:LEU:HD23	2.00	0.44
1:B:186:ARG:NH2	3:B:409:HOH:O	2.51	0.44
1:B:137:PRO:HA	1:B:140:VAL:HG22	2.00	0.43
1:B:137:PRO:O	1:B:140:VAL:HG22	2.17	0.43
1:A:144:LEU:HD21	1:A:168:ILE:HD11	2.00	0.42
1:B:39:THR:HG1	1:B:67:THR:HG1	1.63	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	237/263 (90%)	233 (98%)	4 (2%)	0	100	100
1	B	221/263 (84%)	216 (98%)	4 (2%)	1 (0%)	29	9
All	All	458/526 (87%)	449 (98%)	8 (2%)	1 (0%)	47	23

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	225	ASP

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	195/213 (92%)	192 (98%)	3 (2%)	65	37
1	B	183/213 (86%)	181 (99%)	2 (1%)	73	53
All	All	378/426 (89%)	373 (99%)	5 (1%)	69	44

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	ARG
1	A	25	ASP
1	A	145	ARG
1	B	25	ASP
1	B	145	ARG

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands are modelled in this entry.

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
2	PGE	A	301	-	9,9,9	0.31	0	8,8,8	0.52	0
2	PGE	B	301	-	9,9,9	0.35	0	8,8,8	0.84	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	PGE	A	301	-	-	0/7/7/7	-
2	PGE	B	301	-	-	3/7/7/7	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	301	PGE	O3-C5-C6-O4
2	B	301	PGE	O1-C1-C2-O2
2	B	301	PGE	C6-C5-O3-C4

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

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	240/263 (91%)	0.35	16 (6%) 17 21	18, 27, 53, 73	0
1	B	226/263 (85%)	0.72	32 (14%) 2 2	19, 32, 60, 79	0
All	All	466/526 (88%)	0.53	48 (10%) 6 7	18, 29, 58, 79	0

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	148	LEU	10.5
1	B	143	LEU	7.3
1	B	144	LEU	7.1
1	B	70	GLY	6.6
1	B	42	LYS	6.5
1	A	150	THR	6.1
1	B	140	VAL	6.1
1	A	154	VAL	5.9
1	B	142	HIS	5.8
1	B	148	LEU	5.5
1	B	69	LEU	5.1
1	A	153	THR	4.9
1	B	162	GLY	4.7
1	B	3	ILE	4.7
1	A	146	PRO	4.4
1	B	147	ALA	4.3
1	A	149	ASP	4.1
1	B	168	ILE	4.1
1	A	147	ALA	4.1
1	B	141	ARG	3.9
1	A	253	GLY	3.8
1	B	137	PRO	3.7
1	A	144	LEU	3.5
1	B	145	ARG	3.5

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Mol	Chain	Res	Type	RSRZ
1	B	175	GLU	3.4
1	B	44	LEU	3.4
1	A	167	ARG	3.4
1	B	202	ILE	3.4
1	B	138	ALA	3.4
1	A	42	LYS	3.2
1	B	26	THR	3.1
1	A	155	GLY	3.1
1	B	176	LEU	3.0
1	B	232	SER	2.9
1	A	70	GLY	2.5
1	B	253	GLY	2.5
1	B	45	LYS	2.5
1	B	164	ARG	2.5
1	B	66	PHE	2.5
1	B	199	THR	2.4
1	A	168	ILE	2.4
1	B	201	GLN	2.3
1	B	67	THR	2.2
1	B	178	ARG	2.2
1	B	2	GLN	2.1
1	B	15	ARG	2.1
1	A	145	ARG	2.1
1	A	15	ARG	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 monosaccharides 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(\AA^2)	Q<0.9
2	PGE	A	301	10/10	0.86	0.15	43,52,61,62	0
2	PGE	B	301	10/10	0.91	0.13	43,52,66,70	0

6.5 Other polymers [i](#)

There are no such residues in this entry.