



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 02:40 AM UTC

PDB ID : 5IOJ / pdb_00005ioj
Title : Crystal structure of the Sphingobium sp. TCM1 phosphotriesterase without the binuclear manganese center
Authors : Mabanglo, M.F.; Raushel, F.M.
Deposited on : 2016-03-08
Resolution : 1.76 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)	:	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

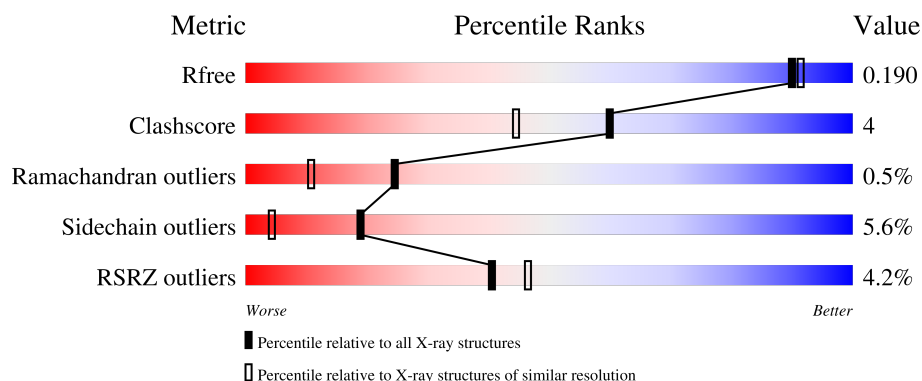
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.76 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	3183 (1.76-1.76)
Clashscore	190562	3299 (1.76-1.76)
Ramachandran outliers	187476	3274 (1.76-1.76)
Sidechain outliers	187428	3274 (1.76-1.76)
RSRZ outliers	180081	3183 (1.76-1.76)

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	591	4% 71% 10% • 17%
1	B	591	3% 73% 8% • 18%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 8320 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 Haloalkylphosphorus hydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	489	Total	C	N	O	S	0	1	2
			3707	2331	672	692	12			
1	B	484	Total	C	N	O	S	0	0	1
			3661	2303	666	681	11			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	584	LEU	-	expression tag	UNP A0A077JBW9
A	585	GLU	-	expression tag	UNP A0A077JBW9
A	586	HIS	-	expression tag	UNP A0A077JBW9
A	587	HIS	-	expression tag	UNP A0A077JBW9
A	588	HIS	-	expression tag	UNP A0A077JBW9
A	589	HIS	-	expression tag	UNP A0A077JBW9
A	590	HIS	-	expression tag	UNP A0A077JBW9
A	591	HIS	-	expression tag	UNP A0A077JBW9
B	584	LEU	-	expression tag	UNP A0A077JBW9
B	585	GLU	-	expression tag	UNP A0A077JBW9
B	586	HIS	-	expression tag	UNP A0A077JBW9
B	587	HIS	-	expression tag	UNP A0A077JBW9
B	588	HIS	-	expression tag	UNP A0A077JBW9
B	589	HIS	-	expression tag	UNP A0A077JBW9
B	590	HIS	-	expression tag	UNP A0A077JBW9
B	591	HIS	-	expression tag	UNP A0A077JBW9

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	445	Total	O	0	0
			445	445		
2	B	507	Total	O	0	0
			507	507		

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	88.31Å 93.92Å 112.49Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.96 – 1.76 39.96 – 1.76	Depositor EDS
% Data completeness (in resolution range)	99.8 (39.96-1.76) 99.9 (39.96-1.76)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.87 (at 1.76Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.161 , 0.192 (Not available) , 0.190	Depositor DCC
R_{free} test set	2002 reflections (2.15%)	wwPDB-VP
Wilson B-factor (Å ²)	20.7	Xtriage
Anisotropy	0.754	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 49.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	8320	wwPDB-VP
Average B, all atoms (Å ²)	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.10% 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](#)

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	0.43	0/3803	0.83	5/5178 (0.1%)
1	B	0.43	0/3760	0.77	0/5120
All	All	0.43	0/7563	0.80	5/10298 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	375	PRO	CA-C-O	-6.96	113.17	122.08
1	A	375	PRO	CA-C-N	6.30	133.04	121.70
1	A	375	PRO	C-N-CA	6.30	133.04	121.70
1	A	92	GLY	CA-C-N	5.55	125.21	119.05
1	A	92	GLY	C-N-CA	5.55	125.21	119.05

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	3707	0	3668	43	0
1	B	3661	0	3632	21	0
2	A	445	0	0	9	0
2	B	507	0	0	4	0
All	All	8320	0	7300	64	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 4.

All (64) 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:562:THR:HG23	1:A:565:HIS:HE1	1.42	0.84
1:A:516:PRO:HB2	1:A:562:THR:HG21	1.61	0.81
1:B:88:GLN:OE1	1:B:576:ARG:NH2	2.16	0.78
1:B:435:LEU:HD21	1:B:498:ARG:HD2	1.68	0.75
1:A:562:THR:HG23	1:A:565:HIS:CE1	2.24	0.73
1:B:211:ARG:NH2	1:B:290:ILE:O	2.24	0.69
1:A:274[B]:VAL:HG23	1:A:315:THR:HB	1.75	0.68
1:A:274[A]:VAL:HG12	1:A:278:LEU:HD23	1.78	0.66
1:A:375:PRO:HA	1:A:376:LYS:HB2	1.77	0.65
1:A:352:ASP:N	1:A:353:VAL:HG22	2.14	0.62
1:A:274[A]:VAL:HG13	1:A:315:THR:HB	1.81	0.61
1:A:151:THR:HG21	1:A:173:GLY:H	1.66	0.61
1:A:559:CYS:HB2	1:A:562:THR:HG22	1.85	0.58
1:B:498:ARG:HD3	1:B:510:GLU:OE1	2.05	0.57
1:B:326:ARG:NH2	1:B:370:ASP:OD1	2.38	0.57
1:A:146:CYS:SG	1:A:243:LEU:HD13	2.45	0.56
1:A:349:SER:O	2:A:601:HOH:O	2.18	0.55
1:A:378:ARG:NH1	2:A:609:HOH:O	2.38	0.55
1:B:194:ARG:NH2	2:B:606:HOH:O	2.39	0.54
1:A:487:LEU:HD21	1:A:569:LEU:HD11	1.88	0.54
1:B:350:ASP:HB3	1:B:451:ARG:HH12	1.72	0.54
1:A:421:ILE:HG22	1:A:427:PRO:HB3	1.89	0.53
1:B:372:ARG:HG2	1:B:373:SER:O	2.09	0.53
1:A:367:ASP:HB3	1:A:375:PRO:HB3	1.91	0.53
1:A:444:ASP:OD1	2:A:602:HOH:O	2.19	0.52
1:A:151:THR:CG2	1:A:173:GLY:H	2.21	0.52
1:A:516:PRO:CB	1:A:562:THR:HG21	2.35	0.52
1:B:134:ARG:HB2	1:B:171:PRO:HG2	1.92	0.51
1:A:452:LYS:NZ	2:A:606:HOH:O	2.33	0.51
1:A:98:GLU:OE2	1:A:498:ARG:NH2	2.34	0.50
1:A:367:ASP:CG	1:A:378:ARG:HH12	2.20	0.49
1:B:351:GLY:HA2	1:B:352:ASP:HB2	1.96	0.48
1:B:93:PRO:HA	1:B:94:GLY:HA2	1.67	0.48
1:A:435:LEU:HD21	1:A:498:ARG:HD2	1.94	0.47
1:B:288:LEU:HD11	1:B:296:PRO:HB2	1.95	0.47
1:B:272:THR:HB	1:B:316:PRO:O	2.14	0.47
1:A:428:LYS:HB3	1:A:428:LYS:HE3	1.57	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:551:GLU:H	1:A:551:GLU:CD	2.23	0.46
1:A:274[B]:VAL:HG21	1:A:317:HIS:NE2	2.30	0.46
1:A:487:LEU:HD22	1:A:579:PHE:CZ	2.50	0.46
1:A:120:HIS:HE1	2:A:983:HOH:O	1.99	0.46
1:A:169:ARG:NH2	2:A:608:HOH:O	2.37	0.45
1:A:134:ARG:HB2	1:A:171:PRO:HG2	1.99	0.45
1:B:351:GLY:HA2	1:B:352:ASP:CB	2.46	0.45
1:B:444:ASP:OD2	2:B:601:HOH:O	2.21	0.45
1:B:132:TRP:CZ2	1:B:187:PRO:HB2	2.52	0.44
1:A:451:ARG:NE	2:A:602:HOH:O	2.30	0.44
1:B:432:GLU:OE2	2:B:602:HOH:O	2.21	0.44
1:A:274[B]:VAL:HG22	1:A:278:LEU:HD23	1.99	0.43
1:A:449:THR:HG21	2:B:1025:HOH:O	2.18	0.43
1:A:554:HIS:HE1	2:A:624:HOH:O	2.01	0.43
1:A:367:ASP:OD1	1:A:372:ARG:HD2	2.19	0.42
1:A:151:THR:HG22	2:A:672:HOH:O	2.20	0.42
1:A:136:GLY:O	1:A:151:THR:HA	2.20	0.42
1:A:547:ARG:HB3	1:A:556:TRP:HB2	2.01	0.42
1:A:272:THR:HB	1:A:316:PRO:O	2.19	0.42
1:B:317:HIS:HB2	1:B:388:PHE:O	2.19	0.42
1:A:340:VAL:HA	1:A:341:PRO:HD3	1.88	0.42
1:A:135:GLY:HA2	1:A:561:THR:HA	2.01	0.41
1:A:367:ASP:HA	1:A:372:ARG:HD2	2.02	0.41
1:B:435:LEU:CD2	1:B:498:ARG:HD2	2.45	0.41
1:B:358:GLY:HA3	1:B:388:PHE:HB3	2.03	0.41
1:A:357:ASN:HB2	1:A:385:GLN:OE1	2.21	0.41

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	487/591 (82%)	465 (96%)	19 (4%)	3 (1%)	21	8
1	B	482/591 (82%)	459 (95%)	21 (4%)	2 (0%)	30	15
All	All	969/1182 (82%)	924 (95%)	40 (4%)	5 (0%)	24	11

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	376	LYS
1	A	352	ASP
1	A	200	VAL
1	B	200	VAL
1	B	406	ALA

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	396/476 (83%)	371 (94%)	25 (6%)	16	3
1	B	391/476 (82%)	372 (95%)	19 (5%)	22	6
All	All	787/952 (83%)	743 (94%)	44 (6%)	19	4

All (44) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	90	VAL
1	A	91	ILE
1	A	138	LEU
1	A	166	LEU
1	A	179	VAL
1	A	188	VAL
1	A	243	LEU
1	A	247	LEU
1	A	310	LEU
1	A	314	PHE
1	A	349	SER

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Mol	Chain	Res	Type
1	A	352	ASP
1	A	353	VAL
1	A	355	VAL
1	A	408	LEU
1	A	417	ARG
1	A	428	LYS
1	A	449	THR
1	A	477	ASN
1	A	487	LEU
1	A	551	GLU
1	A	562	THR
1	A	572	ASP
1	A	577	LEU
1	A	581	THR
1	B	88	GLN
1	B	158	ILE
1	B	166	LEU
1	B	179	VAL
1	B	186	LYS
1	B	206	ILE
1	B	214	LEU
1	B	295	ARG
1	B	314	PHE
1	B	339	ASP
1	B	352	ASP
1	B	373	SER
1	B	374	GLN
1	B	417	ARG
1	B	449	THR
1	B	477	ASN
1	B	487	LEU
1	B	577	LEU
1	B	582	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	145	GLN
1	B	323	HIS

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 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

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	487/591 (82%)	0.62	24 (4%)	35	40	19, 41, 61, 115	1 (0%)
1	B	482/591 (81%)	0.50	17 (3%)	47	53	31, 37, 59, 106	0
All	All	969/1182 (81%)	0.56	41 (4%)	40	46	19, 39, 60, 115	1 (0%)

All (41) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	582	VAL	4.5
1	B	349	SER	4.2
1	B	350	ASP	4.2
1	B	158	ILE	3.7
1	B	351	GLY	3.7
1	A	91	ILE	3.6
1	B	353	VAL	3.6
1	B	94	GLY	3.6
1	A	375	PRO	3.5
1	A	355	VAL	3.5
1	B	572	ASP	3.4
1	A	575	ALA	3.3
1	B	339	ASP	3.2
1	A	274[A]	VAL	3.2
1	A	351	GLY	3.1
1	B	449	THR	3.1
1	A	349	SER	3.0
1	B	352	ASP	3.0
1	A	94	GLY	2.9
1	B	93	PRO	2.9
1	A	353	VAL	2.9
1	A	339	ASP	2.9
1	A	350	ASP	2.8
1	B	91	ILE	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	123	VAL	2.7
1	A	354	PRO	2.6
1	A	577	LEU	2.6
1	A	88	GLN	2.5
1	A	581	THR	2.4
1	A	93	PRO	2.4
1	A	562	THR	2.4
1	A	352	ASP	2.3
1	A	151	THR	2.2
1	A	348	ALA	2.2
1	B	575	ALA	2.2
1	B	577	LEU	2.2
1	B	397	ASN	2.2
1	A	188	VAL	2.2
1	A	376	LYS	2.2
1	A	572	ASP	2.1
1	A	90	VAL	2.1

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.