



wwPDB X-ray Structure Validation Summary Report ⓘ

May 27, 2020 – 12:47 am BST

PDB ID : 2Q2E
Title : Crystal structure of the topoisomerase VI holoenzyme from *Methanosarcina mazei*
Authors : Corbett, K.D.; Benedetti, P.; Berger, J.M.
Deposited on : 2007-05-28
Resolution : 4.00 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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
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

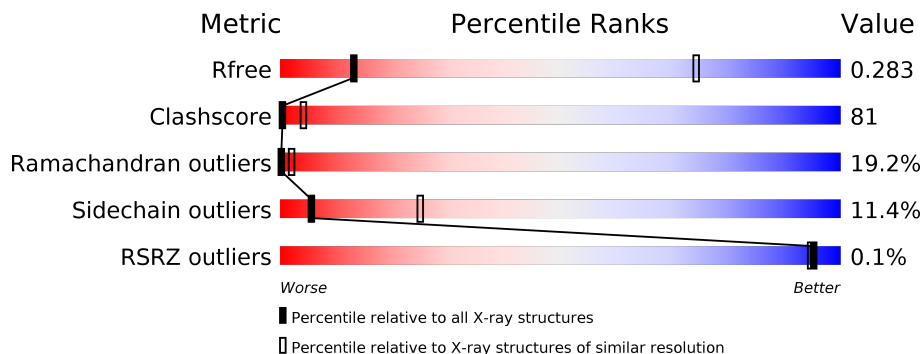
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 4.00 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	1087 (4.30-3.70)
Clashscore	141614	1148 (4.30-3.70)
Ramachandran outliers	138981	1108 (4.30-3.70)
Sidechain outliers	138945	1099 (4.30-3.70)
RSRZ outliers	127900	1028 (4.34-3.66)

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	369	
2	B	621	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7039 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 Type II DNA topoisomerase VI subunit A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	315	2532	1610	423	490	9	0	0	0

- Molecule 2 is a protein called Type 2 DNA topoisomerase 6 subunit B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	582	4507	2878	768	843	18	0	0	1

V561	D500	V380	I320	Y352
I501	I501	F361	G321	T263
M564	M502	L382	E322	E294
D567	F503	L383	D323	ARG
Y568	V504	I444	I324	GLN
D569	V505	K445	I325	LYS
Y570	A506	Q365	I326	LEU
V571	K507	Q386	K327	ALA
S575	I508	G388	G328	P260
A576	M509	C389	L329	F261
S577	G510	V390	E330	L262
S580	N511	A391	K331	R263
S581	L512	T392	E332	C267
S582	L513	E393	T333	K268
S583	V514	A394	T334	ILE
S584	H515	V395	V335	GLY
S585	R516	A396	D336	L271
S586	V517	D397	F337	L272
S587	I518	K458	I338	T273
S588	M521	L459	K339	A274
S589	G522	W400	T340	I277
S590	D523	K401	S341	I277
A591	E524	Q402	T342	C278
A592	T525	Y403	R343	A281
A593	V526	G404	K344	G282
A594	D527	L405	P345	L283
A595	D528	N406	A346	D284
A596	V529	Q407	V347	P285
A597	A530	N468	P348	E286
A598	I531	L469	S349	L287
A599	K531	G409	G350	D288
A600	V532	G410	G351	P289
A601	M533	G411	M351	H290
A602	K534	G412	P352	A291
A603	PHE	R472	G352	L292
A604	GLY	R473	P353	A297
A605	THR	E474	V354	L300
A606	SER	K475	V355	I301
A607	A539	E476	G355	E302
A608	Y540	I477	E356	A303
A609	S541	I478	L365	F304
A610	F542	I479	L366	E305
A611	R543	T480	P366	K306
A612	V544	K481	A360	V307
A613	H545	V482	G362	K308
A614	E546	L483	M364	I309
A615	M547	P484	L365	M310
A616	L548	K485	L366	A311
A617	C550	K486	P367	P312
A618	M551	A487	K367	P313
A619	V552	A488	E368	T314
A620	SER	K489	E369	D815
A621	GLY	V490	K370	C316
A622	LYS	A491	I371	L317
A623	GLY	H492	S372	S318
A624	ALA	V493	I373	P319
A625	GLY	L494	M374	
A626	VAL	E495	R375	
A627	LEU	K496	F376	
A628	VAL	D497	A377	
A629	LEU	V498	N378	
A630	ALA	P499	R379	
A631	ALA			
A632	PHE			
A633	LYS			
A634	GLY			
A635	VAL			

4 Data and refinement statistics

Property	Value	Source
Space group	P 64 2 2	Depositor
Cell constants a, b, c, α , β , γ	227.81Å 227.81Å 208.66Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 4.00 92.23 – 4.00	Depositor EDS
% Data completeness (in resolution range)	94.2 (30.00-4.00) 94.1 (92.23-4.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.20 (at 4.01Å)	Xtrriage
Refinement program	REFMAC 5.3.0026	Depositor
R, R_{free}	0.306 , 0.349 0.302 , 0.283	Depositor DCC
R_{free} test set	1298 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	153.1	Xtrriage
Anisotropy	0.370	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 210.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	7039	wwPDB-VP
Average B, all atoms (Å ²)	192.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.40% 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	0.41	0/2579	0.71	0/3471
2	B	0.51	1/4591 (0.0%)	0.83	5/6215 (0.1%)
All	All	0.47	1/7170 (0.0%)	0.79	5/9686 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	53	CYS	CB-SG	-6.66	1.71	1.82

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	57	GLY	N-CA-C	5.88	127.79	113.10
2	B	408	PRO	N-CA-CB	5.82	110.29	103.30
2	B	522	GLY	N-CA-C	-5.75	98.72	113.10
2	B	58	ILE	N-CA-C	5.66	126.29	111.00
2	B	362	GLY	N-CA-C	5.42	126.64	113.10

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	2532	0	2476	393	0
2	B	4507	0	4565	779	0
All	All	7039	0	7041	1140	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 81.

The worst 5 of 1140 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)
2:B:599:LEU:H	2:B:599:LEU:HD23	1.09	1.13
2:B:516:ARG:HH12	2:B:597:GLN:HB2	0.93	1.09
2:B:371:ILE:HG22	2:B:414:VAL:HG12	1.13	1.09
2:B:66:VAL:HG23	2:B:213:PRO:HD3	1.35	1.08
2:B:222:ARG:HH21	2:B:332:GLU:HB2	1.12	1.06

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	303/369 (82%)	163 (54%)	78 (26%)	62 (20%)	0 2
2	B	566/621 (91%)	339 (60%)	122 (22%)	105 (19%)	0 2
All	All	869/990 (88%)	502 (58%)	200 (23%)	167 (19%)	0 2

5 of 167 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	29	ASN
1	A	72	VAL
1	A	97	ARG
1	A	112	ASP
1	A	113	TYR

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	268/315 (85%)	240 (90%)	28 (10%)	7	28
2	B	486/527 (92%)	428 (88%)	58 (12%)	5	24
All	All	754/842 (90%)	668 (89%)	86 (11%)	5	25

5 of 86 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	109	SER
2	B	171	PRO
2	B	540	TYR
2	B	117	ILE
2	B	159	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	25	ASN
2	B	48	ASN
2	B	190	GLN
1	A	344	GLN
2	B	378	ASN

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](#)

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 [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, 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	315/369 (85%)	-0.04	1 (0%) 94 90	139, 217, 258, 265	0
2	B	582/621 (93%)	-0.06	0 100 100	93, 175, 248, 265	0
All	All	897/990 (90%)	-0.05	1 (0%) 95 94	93, 192, 254, 265	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	155	ILE	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 carbohydrates 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.