



wwPDB X-ray Structure Validation Summary Report ⓘ

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PDB ID : 4Q7C
Title : Structure of AF2299, a CDP-alcohol phosphotransferase
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Deposited on : 2014-04-24
Resolution : 3.10 Å(reported)

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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	:	1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix)	:	1.13
EDS	:	trunk31020
Percentile statistics	:	20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac	:	5.8.0158
CCP4	:	7.0 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk31020

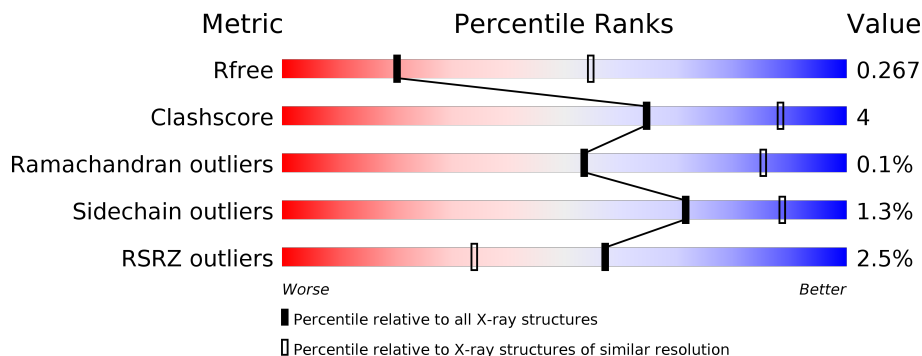
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.10 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}	111664	1115 (3.12-3.08)
Clashscore	122126	1042 (3.10-3.10)
Ramachandran outliers	120053	1010 (3.10-3.10)
Sidechain outliers	120020	1010 (3.10-3.10)
RSRZ outliers	108989	1089 (3.12-3.08)

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. 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	372	
1	B	372	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 5412 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 AF2299, a CDP-alcohol phosphotransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	332	Total	C	N	O	S	0	0	0
			2585	1702	413	464	6			
1	B	341	Total	C	N	O	S	0	0	0
			2687	1767	435	479	6			

There are 56 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-27	MET	-	EXPRESSION TAG	UNP O27985
A	-26	HIS	-	EXPRESSION TAG	UNP O27985
A	-25	HIS	-	EXPRESSION TAG	UNP O27985
A	-24	HIS	-	EXPRESSION TAG	UNP O27985
A	-23	HIS	-	EXPRESSION TAG	UNP O27985
A	-22	HIS	-	EXPRESSION TAG	UNP O27985
A	-21	HIS	-	EXPRESSION TAG	UNP O27985
A	-20	HIS	-	EXPRESSION TAG	UNP O27985
A	-19	HIS	-	EXPRESSION TAG	UNP O27985
A	-18	HIS	-	EXPRESSION TAG	UNP O27985
A	-17	HIS	-	EXPRESSION TAG	UNP O27985
A	-16	SER	-	EXPRESSION TAG	UNP O27985
A	-15	SER	-	EXPRESSION TAG	UNP O27985
A	-14	GLY	-	EXPRESSION TAG	UNP O27985
A	-13	VAL	-	EXPRESSION TAG	UNP O27985
A	-12	ASP	-	EXPRESSION TAG	UNP O27985
A	-11	LEU	-	EXPRESSION TAG	UNP O27985
A	-10	GLY	-	EXPRESSION TAG	UNP O27985
A	-9	THR	-	EXPRESSION TAG	UNP O27985
A	-8	GLU	-	EXPRESSION TAG	UNP O27985
A	-7	ASN	-	EXPRESSION TAG	UNP O27985
A	-6	LEU	-	EXPRESSION TAG	UNP O27985
A	-5	TYR	-	EXPRESSION TAG	UNP O27985
A	-4	PHE	-	EXPRESSION TAG	UNP O27985
A	-3	GLN	-	EXPRESSION TAG	UNP O27985

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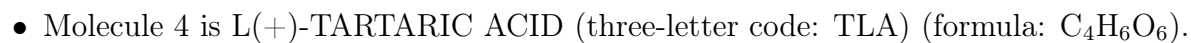
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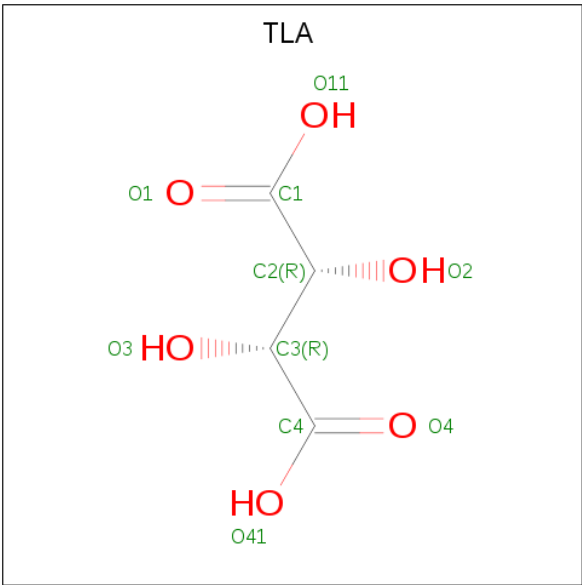
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	EXPRESSION TAG	UNP O27985
A	-1	ASN	-	EXPRESSION TAG	UNP O27985
A	0	ALA	-	EXPRESSION TAG	UNP O27985
B	-27	MET	-	EXPRESSION TAG	UNP O27985
B	-26	HIS	-	EXPRESSION TAG	UNP O27985
B	-25	HIS	-	EXPRESSION TAG	UNP O27985
B	-24	HIS	-	EXPRESSION TAG	UNP O27985
B	-23	HIS	-	EXPRESSION TAG	UNP O27985
B	-22	HIS	-	EXPRESSION TAG	UNP O27985
B	-21	HIS	-	EXPRESSION TAG	UNP O27985
B	-20	HIS	-	EXPRESSION TAG	UNP O27985
B	-19	HIS	-	EXPRESSION TAG	UNP O27985
B	-18	HIS	-	EXPRESSION TAG	UNP O27985
B	-17	HIS	-	EXPRESSION TAG	UNP O27985
B	-16	SER	-	EXPRESSION TAG	UNP O27985
B	-15	SER	-	EXPRESSION TAG	UNP O27985
B	-14	GLY	-	EXPRESSION TAG	UNP O27985
B	-13	VAL	-	EXPRESSION TAG	UNP O27985
B	-12	ASP	-	EXPRESSION TAG	UNP O27985
B	-11	LEU	-	EXPRESSION TAG	UNP O27985
B	-10	GLY	-	EXPRESSION TAG	UNP O27985
B	-9	THR	-	EXPRESSION TAG	UNP O27985
B	-8	GLU	-	EXPRESSION TAG	UNP O27985
B	-7	ASN	-	EXPRESSION TAG	UNP O27985
B	-6	LEU	-	EXPRESSION TAG	UNP O27985
B	-5	TYR	-	EXPRESSION TAG	UNP O27985
B	-4	PHE	-	EXPRESSION TAG	UNP O27985
B	-3	GLN	-	EXPRESSION TAG	UNP O27985
B	-2	SER	-	EXPRESSION TAG	UNP O27985
B	-1	ASN	-	EXPRESSION TAG	UNP O27985
B	0	ALA	-	EXPRESSION TAG	UNP O27985

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	2	Total Ca 2 2	0	0
2	A	2	Total Ca 2 2	0	0

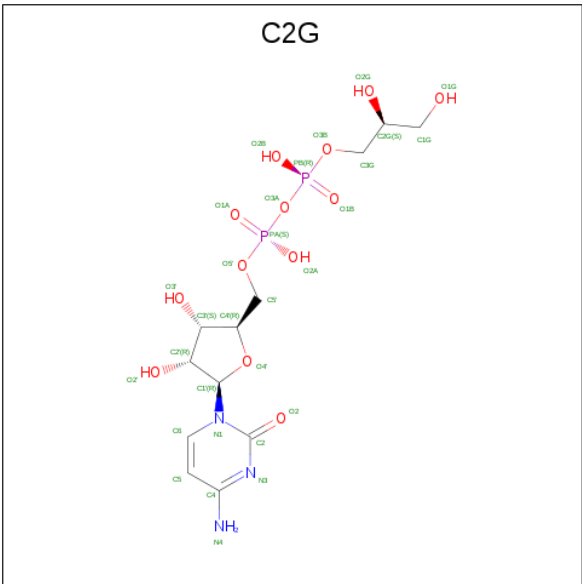
- Molecule 3 is [(Z)-octadec-9-enyl] (2R)-2,3-bis(oxidanyl)propanoate (three-letter code: MPG) (formula: C₂₁H₄₀O₄).





Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			10	4	6		
4	B	1	Total	C	O	0	0
			10	4	6		

- Molecule 5 is [CYTIDINE-5'-PHOSPHATE] GLYCERYLPHOSPHORIC ACID ESTER (three-letter code: C2G) (formula: C₁₂H₂₁N₃O₁₃P₂).



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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	B	1	Total	C	N	O	P	0	0
			30	12	3	13	2		

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	46.42Å 90.85Å 106.61Å 90.00° 92.21° 90.00°	Depositor
Resolution (Å)	69.13 – 3.10 69.13 – 3.10	Depositor EDS
% Data completeness (in resolution range)	99.8 (69.13-3.10) 99.8 (69.13-3.10)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.71 (at 3.13Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.238 , 0.269 0.234 , 0.267	Depositor DCC
R_{free} test set	803 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	56.9	Xtriage
Anisotropy	0.495	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 32.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.044 for h,-k,-l	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	5412	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.43% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MPG, CA, TLA, C2G

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	0.23	0/2636	0.39	0/3582
1	B	0.24	0/2741	0.40	0/3718
All	All	0.23	0/5377	0.39	0/7300

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

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	2585	0	2606	27	1
1	B	2687	0	2741	21	1
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	28	0	52	2	0
3	B	28	0	52	1	0
4	A	10	0	4	1	0
4	B	10	0	4	0	0
5	A	30	0	19	1	0
5	B	30	0	19	2	0
All	All	5412	0	5497	49	1

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.

The worst 5 of 49 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)
5:B:408:C2G:O4'	5:B:408:C2G:C1'	1.64	1.24
5:A:408:C2G:C1'	5:A:408:C2G:O4'	1.64	1.13
1:A:69:ARG:NH1	1:A:102:TYR:OH	2.21	0.72
1:B:21:LEU:HD13	1:B:118:LEU:HD13	1.79	0.64
1:A:70:LYS:HD2	1:A:111:TYR:HB2	1.80	0.62

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:81:TYR:OH	1:B:45:GLU:OE2[2_645]	2.18	0.02

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	328/372 (88%)	319 (97%)	8 (2%)	1 (0%)	43	77
1	B	339/372 (91%)	330 (97%)	9 (3%)	0	100	100
All	All	667/744 (90%)	649 (97%)	17 (2%)	1 (0%)	53	85

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	341	SER

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	271/322 (84%)	268 (99%)	3 (1%)	76	90
1	B	283/322 (88%)	279 (99%)	4 (1%)	69	88
All	All	554/644 (86%)	547 (99%)	7 (1%)	71	88

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	120	ASN
1	B	266	PHE
1	B	138	LYS
1	A	248	PHE
1	B	248	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	106	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

Of 16 ligands modelled in this entry, 4 are monoatomic - leaving 12 for Mogul analysis.

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
3	MPG	A	403	-	6,6,24	0.15	0	5,5,25	0.54	0
3	MPG	A	404	-	6,6,24	0.13	0	5,5,25	0.65	0
3	MPG	A	405	-	6,6,24	0.14	0	5,5,25	0.59	0
3	MPG	A	406	-	6,6,24	0.14	0	5,5,25	0.62	0
4	TLA	A	407	-	3,9,9	0.57	0	6,12,12	0.92	0
5	C2G	A	408	2	25,31,31	3.76	5 (20%)	28,46,46	0.82	2 (7%)
3	MPG	B	403	-	6,6,24	0.13	0	5,5,25	0.62	0
3	MPG	B	404	-	6,6,24	0.13	0	5,5,25	0.67	0
3	MPG	B	405	-	6,6,24	0.13	0	5,5,25	0.58	0
3	MPG	B	406	-	6,6,24	0.14	0	5,5,25	0.58	0
4	TLA	B	407	-	3,9,9	0.52	0	6,12,12	0.90	0
5	C2G	B	408	2	25,31,31	3.79	5 (20%)	28,46,46	0.88	2 (7%)

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
3	MPG	A	403	-	-	0/4/4/25	0/0/0/0
3	MPG	A	404	-	-	0/4/4/25	0/0/0/0
3	MPG	A	405	-	-	0/4/4/25	0/0/0/0
3	MPG	A	406	-	-	0/4/4/25	0/0/0/0
4	TLA	A	407	-	-	0/4/12/12	0/0/0/0
5	C2G	A	408	2	-	0/20/40/40	0/2/2/2
3	MPG	B	403	-	-	0/4/4/25	0/0/0/0
3	MPG	B	404	-	-	0/4/4/25	0/0/0/0
3	MPG	B	405	-	-	0/4/4/25	0/0/0/0
3	MPG	B	406	-	-	0/4/4/25	0/0/0/0
4	TLA	B	407	-	-	0/4/12/12	0/0/0/0
5	C2G	B	408	2	-	0/20/40/40	0/2/2/2

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	408	C2G	O4'-C4'	-6.55	1.30	1.45
5	A	408	C2G	O4'-C4'	-6.49	1.30	1.45
5	B	408	C2G	O3'-C3'	-2.24	1.37	1.43
5	A	408	C2G	O3'-C3'	-2.19	1.37	1.43
5	B	408	C2G	C3'-C4'	2.12	1.58	1.53

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	408	C2G	C4'-O4'-C1'	-2.75	106.96	109.83
5	A	408	C2G	PB-O3A-PA	-2.21	125.19	132.63
5	A	408	C2G	N4-C4-N3	2.01	119.84	116.56
5	B	408	C2G	N4-C4-N3	2.18	120.13	116.56

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

6 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	403	MPG	2	0
3	A	406	MPG	1	0
4	A	407	TLA	1	0
5	A	408	C2G	1	0
3	B	406	MPG	1	0
5	B	408	C2G	2	0

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	332/372 (89%)	0.04	12 (3%) 42 21	26, 36, 63, 67	0
1	B	341/372 (91%)	-0.02	5 (1%) 73 54	28, 38, 57, 60	0
All	All	673/744 (90%)	0.01	17 (2%) 57 34	26, 37, 60, 67	0

The worst 5 of 17 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	107	ASN	3.7
1	A	108	LEU	3.1
1	B	293	GLU	2.9
1	A	69	ARG	2.8
1	B	139	ARG	2.8

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, 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	CA	B	402	1/1	0.51	0.10	32,32,32,32	1
3	MPG	A	403	7/25	0.77	0.30	30,32,33,33	0
3	MPG	B	406	7/25	0.80	0.34	30,31,32,33	0
4	TLA	B	407	10/10	0.82	0.33	34,38,40,40	0
4	TLA	A	407	10/10	0.84	0.28	30,32,34,34	0
3	MPG	B	403	7/25	0.87	0.28	30,31,32,34	0
3	MPG	B	405	7/25	0.89	0.25	32,34,34,34	0
3	MPG	A	405	7/25	0.89	0.28	26,27,28,28	0
3	MPG	A	406	7/25	0.90	0.24	30,32,33,33	0
3	MPG	A	404	7/25	0.91	0.30	30,30,31,32	0
2	CA	A	402	1/1	0.92	0.08	32,32,32,32	1
3	MPG	B	404	7/25	0.92	0.32	28,29,30,30	0
2	CA	B	401	1/1	0.93	0.07	32,32,32,32	0
5	C2G	B	408	30/30	0.94	0.18	30,32,36,37	0
5	C2G	A	408	30/30	0.95	0.21	32,33,34,35	0
2	CA	A	401	1/1	0.95	0.07	34,34,34,34	0

6.5 Other polymers [i](#)

There are no such residues in this entry.