



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 07:49 AM GMT

PDB ID : 3CAW
Title : Crystal structure of o-succinylbenzoate synthase from *Bdellovibrio bacteriovorus* liganded with Mg
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Deposited on : 2008-02-20
Resolution : 1.87 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
<http://wwpdb.org/validation/2016/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 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

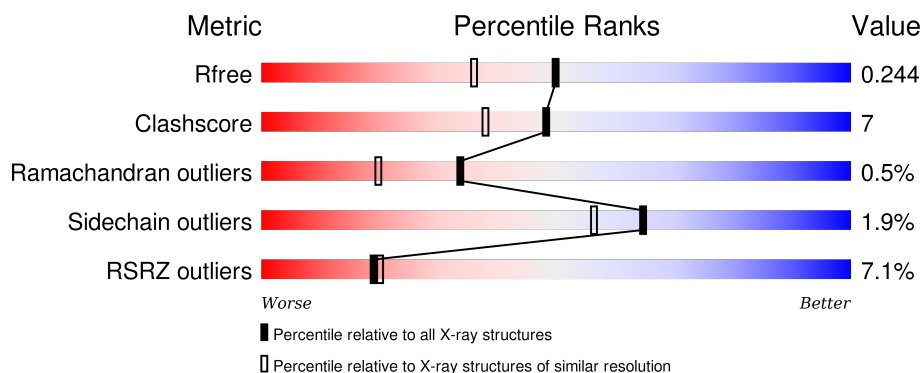
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.87 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}	91344	6965 (1.90-1.86)
Clashscore	102246	7778 (1.90-1.86)
Ramachandran outliers	100387	7691 (1.90-1.86)
Sidechain outliers	100360	7692 (1.90-1.86)
RSRZ outliers	91569	6979 (1.90-1.86)

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 ≥ 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	330	<div> <div>6%</div> <div> <div></div> <div>81%</div> <div>14%</div> <div>• •</div> </div> </div>
1	B	330	<div> <div>8%</div> <div> <div></div> <div>80%</div> <div>15%</div> <div>• •</div> </div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5314 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 o-succinylbenzoate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	316	Total	C	N	O	S	0	0	0
			2535	1637	427	458	13			
1	B	316	Total	C	N	O	S	0	0	0
			2535	1637	427	458	13			

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Mg	0	0
			1	1		
2	A	1	Total	Mg	0	0
			1	1		

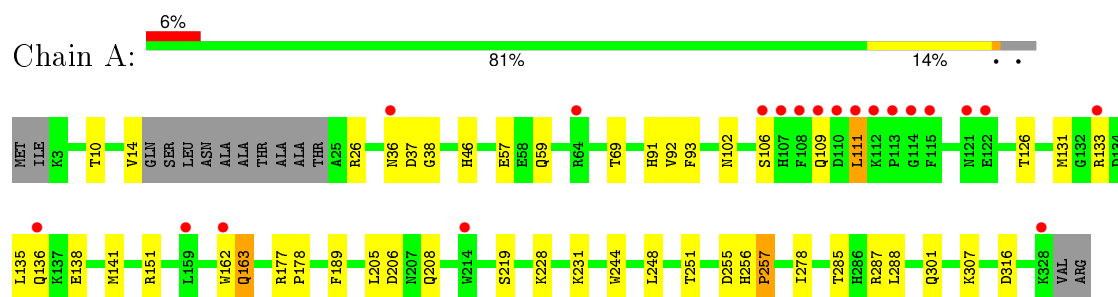
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	118	Total	O	0	0
			118	118		
3	B	124	Total	O	0	0
			124	124		

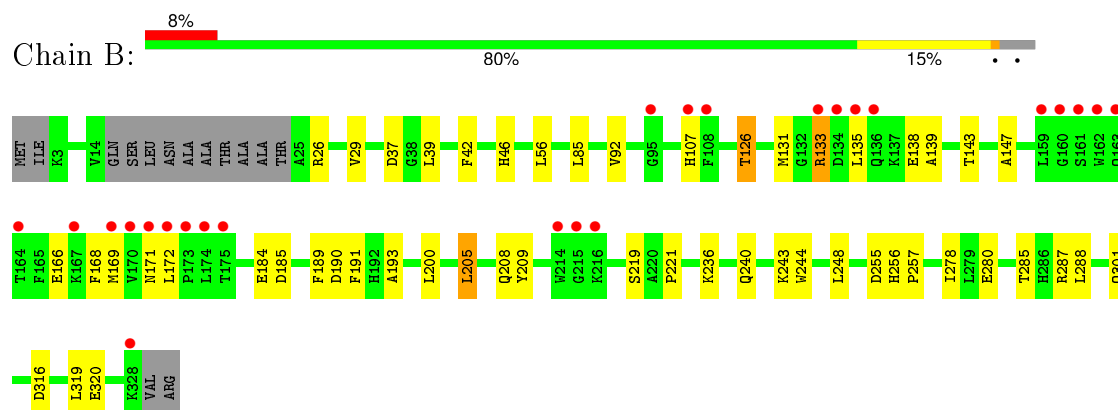
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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 ($\text{RSRZ} > 2$). 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: o-succinylbenzoate synthase



• Molecule 1: o-succinylbenzoate synthase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	53.38Å 78.61Å 78.46Å 90.00° 91.78° 90.00°	Depositor
Resolution (Å)	24.85 – 1.87 29.70 – 1.87	Depositor EDS
% Data completeness (in resolution range)	97.1 (24.85-1.87) 97.3 (29.70-1.87)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	11.61 (at 1.87Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.218 , 0.244 0.219 , 0.244	Depositor DCC
R_{free} test set	2628 reflections (5.04%)	DCC
Wilson B-factor (Å ²)	19.3	Xtriage
Anisotropy	0.487	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 52.7	EDS
Estimated twinning fraction	0.023 for -h,-l,-k 0.010 for -h,l,k 0.069 for h,-k,-l	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Outliers	0 of 52453 reflections	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	5314	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.90% 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, 0.375 respectively for untwinned datasets, and 0.333, 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

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	0.31	0/2596	0.58	0/3507
1	B	0.31	0/2596	0.59	0/3507
All	All	0.31	0/5192	0.58	0/7014

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	2535	0	2545	39	0
1	B	2535	0	2545	36	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	118	0	0	2	0
3	B	124	0	0	0	0
All	All	5314	0	5090	74	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 7.

All (74) 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:26:ARG:HE	1:A:46:HIS:HE1	1.17	0.90
1:B:26:ARG:HE	1:B:46:HIS:HE1	1.14	0.86
1:A:14:VAL:HG13	1:B:147:ALA:HA	1.61	0.82
1:A:163:GLN:H	1:A:163:GLN:NE2	1.80	0.79
1:A:163:GLN:HE21	1:A:163:GLN:H	1.30	0.77
1:A:248:LEU:HD11	1:A:278:ILE:HD12	1.65	0.76
1:B:248:LEU:HD11	1:B:278:ILE:HD12	1.67	0.76
1:B:169:MET:HA	1:B:172:LEU:HD23	1.69	0.75
1:A:177:ARG:HB2	1:A:178:PRO:HD3	1.73	0.71
1:B:107:HIS:CE1	1:B:138:GLU:HG2	2.26	0.71
1:A:189:PHE:H	1:A:208:GLN:HE21	1.41	0.68
1:B:189:PHE:H	1:B:208:GLN:HE21	1.40	0.67
1:A:189:PHE:H	1:A:208:GLN:NE2	1.95	0.64
1:A:26:ARG:HE	1:A:46:HIS:CE1	2.08	0.63
1:B:219:SER:HA	1:B:244:TRP:CZ3	2.35	0.61
1:A:111:LEU:HD22	1:A:141:MET:SD	2.45	0.56
1:A:228:LYS:HG2	1:A:251:THR:OG1	2.06	0.55
1:B:133:ARG:HE	1:B:133:ARG:HA	1.71	0.55
1:A:206:ASP:OD1	1:A:228:LYS:HE3	2.08	0.53
1:A:219:SER:HA	1:A:244:TRP:CZ3	2.44	0.53
1:B:236:LYS:O	1:B:240:GLN:HG3	2.10	0.52
1:B:26:ARG:HE	1:B:46:HIS:CE1	2.07	0.52
1:B:190:ASP:HB3	1:B:193:ALA:HB3	1.91	0.52
1:A:126:THR:HG21	3:A:437:HOH:O	2.10	0.52
1:B:107:HIS:NE2	1:B:138:GLU:HG2	2.26	0.51
1:A:285:THR:HB	1:A:288:LEU:HD12	1.93	0.51
1:B:42:PHE:CD2	1:B:319:LEU:HD13	2.47	0.49
1:A:126:THR:HG22	1:A:151:ARG:HB2	1.94	0.49
1:B:135:LEU:HD22	1:B:168:PHE:CD1	2.47	0.49
1:B:37:ASP:CG	1:B:39:LEU:HD13	2.32	0.49
1:B:255:ASP:N	1:B:255:ASP:OD1	2.41	0.49
1:A:287:ARG:HG2	1:A:287:ARG:HH11	1.78	0.48
1:B:316:ASP:O	1:B:320:GLU:HG3	2.13	0.48
1:A:26:ARG:NE	1:A:46:HIS:HE1	1.98	0.48
1:B:189:PHE:H	1:B:208:GLN:NE2	2.09	0.48
1:B:205:LEU:HD11	1:B:209:TYR:HA	1.94	0.48
1:A:36:ASN:C	1:A:38:GLY:H	2.16	0.48
1:A:136:GLN:CD	1:A:136:GLN:H	2.16	0.48
1:A:135:LEU:N	1:A:135:LEU:HD12	2.29	0.48
1:A:102:ASN:HB3	1:A:126:THR:OG1	2.14	0.47
1:A:36:ASN:O	1:A:38:GLY:N	2.47	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:139:ALA:O	1:B:143:THR:HG23	2.15	0.47
1:A:131:MET:HA	1:A:138:GLU:OE1	2.15	0.47
1:A:57:GLU:H	1:A:57:GLU:CD	2.18	0.46
1:B:29:VAL:HG13	1:B:56:LEU:HD21	1.97	0.46
1:B:171:ASN:N	1:B:171:ASN:HD22	2.12	0.46
1:B:126:THR:HG23	1:B:280:GLU:OE1	2.15	0.46
1:A:69:THR:HG23	3:A:505:HOH:O	2.14	0.46
1:A:248:LEU:CD1	1:A:278:ILE:HD12	2.43	0.45
1:B:285:THR:HB	1:B:288:LEU:HD12	1.97	0.45
1:B:131:MET:HA	1:B:138:GLU:OE1	2.17	0.45
1:A:255:ASP:N	1:A:255:ASP:OD1	2.44	0.44
1:B:184:GLU:O	1:B:185:ASP:C	2.56	0.44
1:B:191:PHE:CE1	1:B:221:PRO:HD3	2.52	0.44
1:A:92:VAL:HG13	1:A:93:PHE:HD1	1.82	0.44
1:B:248:LEU:CD1	1:B:278:ILE:HD12	2.44	0.43
1:B:243:LYS:HE2	1:B:244:TRP:CZ2	2.53	0.43
1:A:91:HIS:HB3	1:A:307:LYS:HE3	2.00	0.43
1:A:231:LYS:HB3	1:A:231:LYS:HE2	1.82	0.43
1:B:256:HIS:CG	1:B:257:PRO:HD2	2.52	0.43
1:A:248:LEU:HD12	1:A:248:LEU:C	2.39	0.43
1:B:168:PHE:O	1:B:172:LEU:HD22	2.19	0.42
1:A:10:THR:HA	1:A:26:ARG:O	2.19	0.42
1:A:163:GLN:HE21	1:A:163:GLN:N	2.07	0.42
1:A:256:HIS:CG	1:A:257:PRO:HD2	2.55	0.42
1:A:287:ARG:NH1	1:A:287:ARG:HG2	2.35	0.42
1:A:59:GLN:HG2	1:A:69:THR:HG21	2.01	0.42
1:A:106:SER:HB3	1:A:109:GLN:HE21	1.85	0.41
1:B:287:ARG:HH11	1:B:287:ARG:HG2	1.86	0.41
1:B:85:LEU:HD13	1:B:92:VAL:HA	2.02	0.41
1:B:39:LEU:N	1:B:39:LEU:HD12	2.36	0.40
1:B:171:ASN:N	1:B:171:ASN:ND2	2.68	0.40
1:B:166:GLU:HG3	1:B:200:LEU:HD11	2.02	0.40
1:A:136:GLN:N	1:A:136:GLN:CD	2.75	0.40

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	312/330 (94%)	297 (95%)	12 (4%)	3 (1%)	19	7
1	B	312/330 (94%)	293 (94%)	19 (6%)	0	100	100
All	All	624/660 (94%)	590 (95%)	31 (5%)	3 (0%)	34	20

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	37	ASP
1	A	111	LEU
1	A	133	ARG

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	270/280 (96%)	264 (98%)	6 (2%)	60	50
1	B	270/280 (96%)	266 (98%)	4 (2%)	72	66
All	All	540/560 (96%)	530 (98%)	10 (2%)	65	56

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	162	TRP
1	A	163	GLN
1	A	205	LEU

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Mol	Chain	Res	Type
1	A	257	PRO
1	A	301	GLN
1	A	316	ASP
1	B	126	THR
1	B	133	ARG
1	B	205	LEU
1	B	301	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	46	HIS
1	A	107	HIS
1	A	121	ASN
1	A	157	ASN
1	A	163	GLN
1	A	208	GLN
1	B	46	HIS
1	B	171	ASN
1	B	208	GLN

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 2 ligands modelled in this entry, 2 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

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	316/330 (95%)	0.45	20 (6%) 23 25	11, 21, 46, 60	0
1	B	316/330 (95%)	0.45	25 (7%) 15 16	11, 22, 46, 58	0
All	All	632/660 (95%)	0.45	45 (7%) 19 20	11, 21, 46, 60	0

All (45) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	108	PHE	10.0
1	B	108	PHE	6.9
1	A	36	ASN	6.7
1	B	162	TRP	5.7
1	A	106	SER	5.4
1	A	109	GLN	5.2
1	A	107	HIS	5.1
1	A	110	ASP	4.9
1	B	135	LEU	4.9
1	B	174	LEU	4.8
1	A	328	LYS	4.7
1	A	162	TRP	4.5
1	B	133	ARG	4.0
1	B	175	THR	3.9
1	A	159	LEU	3.9
1	B	172	LEU	3.9
1	B	107	HIS	3.9
1	B	136	GLN	3.8
1	B	170	VAL	3.7
1	B	163	GLN	3.6
1	A	115	PHE	3.6
1	B	159	LEU	3.5
1	A	112	LYS	3.4
1	A	114	GLY	3.3

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Mol	Chain	Res	Type	RSRZ
1	A	121	ASN	3.2
1	A	133	ARG	3.2
1	B	216	LYS	3.2
1	B	134	ASP	3.0
1	B	160	GLY	3.0
1	A	122	GLU	2.9
1	B	167	LYS	2.9
1	B	328	LYS	2.8
1	A	136	GLN	2.8
1	B	161	SER	2.6
1	B	169	MET	2.5
1	B	214	TRP	2.4
1	B	171	ASN	2.2
1	A	111	LEU	2.2
1	B	95	GLY	2.2
1	A	214	TRP	2.2
1	B	173	PRO	2.2
1	B	164	THR	2.2
1	A	64	ARG	2.1
1	B	215	GLY	2.1
1	A	113	PRO	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](#)

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å ²)	Q<0.9
2	MG	B	401	1/1	0.97	0.16	1.57	29,29,29,29	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors(\AA^2)	Q<0.9
2	MG	A	401	1/1	0.93	0.16	1.05	28,28,28,28	0

6.5 Other polymers [i](#)

There are no such residues in this entry.