



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 29, 2020 – 02:09 PM BST

PDB ID : 3RRA  
Title : Crystal structure of enolase PRK14017 (target EFI-500653) from *Ralstonia pickettii* 12J with magnesium bound  
Authors : Patskovsky, Y.; Ramagopal, U.A.; Hillerich, B.; Seidel, R.D.; Zencheck, W.D.; Toro, R.; Imker, H.J.; Gerlt, J.A.; Almo, S.C.; Enzyme Function Initiative (EFI)  
Deposited on : 2011-04-29  
Resolution : 2.30 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](mailto: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.

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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	:	2.13
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

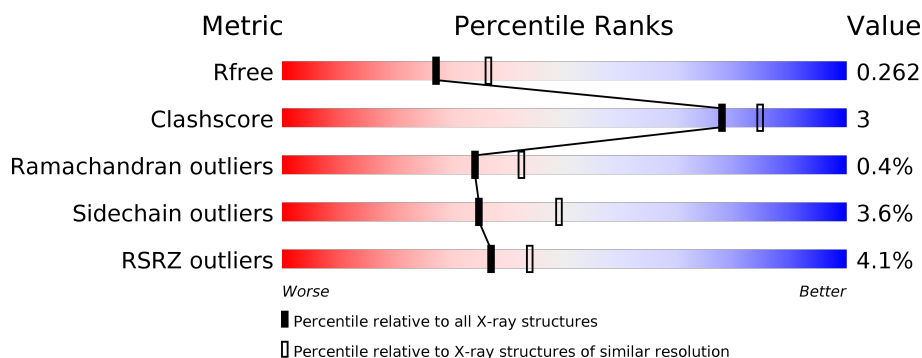
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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  $\geq 3$ , 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	405	<div> <div>2%</div> <div> <div></div> <div>83%</div> <div>9%</div> <div>8%</div> </div> </div>
1	B	405	<div> <div>5%</div> <div> <div></div> <div>86%</div> <div>7%</div> <div>6%</div> </div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5970 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 Putative D-galactonate dehydratase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	374	Total	C	N	O	S	0	1	0
			2891	1847	502	528	14			
1	B	379	Total	C	N	O	S	0	6	0
			2939	1877	514	534	14			

There are 48 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	EXPRESSION TAG	UNP B2UCA8
A	1	VAL	-	EXPRESSION TAG	UNP B2UCA8
A	383	ALA	-	EXPRESSION TAG	UNP B2UCA8
A	384	GLU	-	EXPRESSION TAG	UNP B2UCA8
A	385	ASN	-	EXPRESSION TAG	UNP B2UCA8
A	386	LEU	-	EXPRESSION TAG	UNP B2UCA8
A	387	TYR	-	EXPRESSION TAG	UNP B2UCA8
A	388	PHE	-	EXPRESSION TAG	UNP B2UCA8
A	389	GLN	-	EXPRESSION TAG	UNP B2UCA8
A	390	SER	-	EXPRESSION TAG	UNP B2UCA8
A	391	HIS	-	EXPRESSION TAG	UNP B2UCA8
A	392	HIS	-	EXPRESSION TAG	UNP B2UCA8
A	393	HIS	-	EXPRESSION TAG	UNP B2UCA8
A	394	HIS	-	EXPRESSION TAG	UNP B2UCA8
A	395	HIS	-	EXPRESSION TAG	UNP B2UCA8
A	396	HIS	-	EXPRESSION TAG	UNP B2UCA8
A	397	TRP	-	EXPRESSION TAG	UNP B2UCA8
A	398	SER	-	EXPRESSION TAG	UNP B2UCA8
A	399	HIS	-	EXPRESSION TAG	UNP B2UCA8
A	400	PRO	-	EXPRESSION TAG	UNP B2UCA8
A	401	GLN	-	EXPRESSION TAG	UNP B2UCA8
A	402	PHE	-	EXPRESSION TAG	UNP B2UCA8
A	403	GLU	-	EXPRESSION TAG	UNP B2UCA8
A	404	LYS	-	EXPRESSION TAG	UNP B2UCA8
B	0	MET	-	EXPRESSION TAG	UNP B2UCA8

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Chain	Residue	Modelled	Actual	Comment	Reference
B	1	VAL	-	EXPRESSION TAG	UNP B2UCA8
B	383	ALA	-	EXPRESSION TAG	UNP B2UCA8
B	384	GLU	-	EXPRESSION TAG	UNP B2UCA8
B	385	ASN	-	EXPRESSION TAG	UNP B2UCA8
B	386	LEU	-	EXPRESSION TAG	UNP B2UCA8
B	387	TYR	-	EXPRESSION TAG	UNP B2UCA8
B	388	PHE	-	EXPRESSION TAG	UNP B2UCA8
B	389	GLN	-	EXPRESSION TAG	UNP B2UCA8
B	390	SER	-	EXPRESSION TAG	UNP B2UCA8
B	391	HIS	-	EXPRESSION TAG	UNP B2UCA8
B	392	HIS	-	EXPRESSION TAG	UNP B2UCA8
B	393	HIS	-	EXPRESSION TAG	UNP B2UCA8
B	394	HIS	-	EXPRESSION TAG	UNP B2UCA8
B	395	HIS	-	EXPRESSION TAG	UNP B2UCA8
B	396	HIS	-	EXPRESSION TAG	UNP B2UCA8
B	397	TRP	-	EXPRESSION TAG	UNP B2UCA8
B	398	SER	-	EXPRESSION TAG	UNP B2UCA8
B	399	HIS	-	EXPRESSION TAG	UNP B2UCA8
B	400	PRO	-	EXPRESSION TAG	UNP B2UCA8
B	401	GLN	-	EXPRESSION TAG	UNP B2UCA8
B	402	PHE	-	EXPRESSION TAG	UNP B2UCA8
B	403	GLU	-	EXPRESSION TAG	UNP B2UCA8
B	404	LYS	-	EXPRESSION TAG	UNP B2UCA8

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

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

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

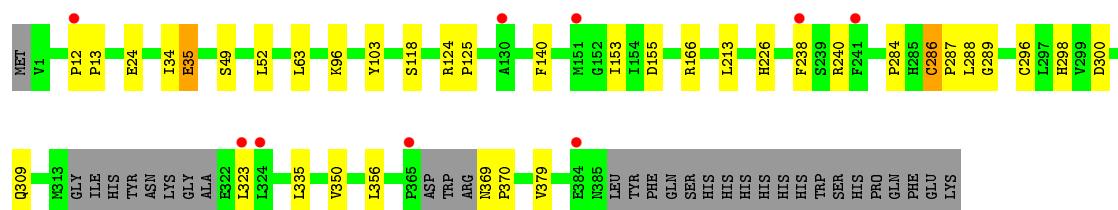
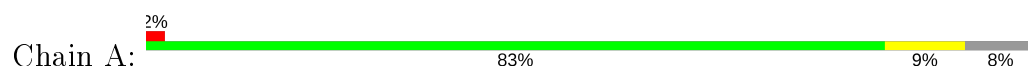
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	57	Total 57	O 57	0	0
4	B	79	Total 79	O 79	0	0

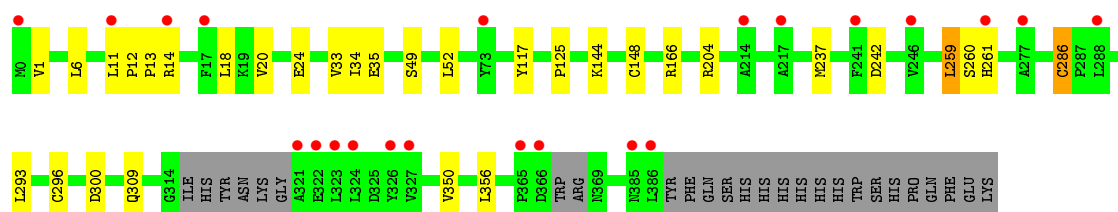
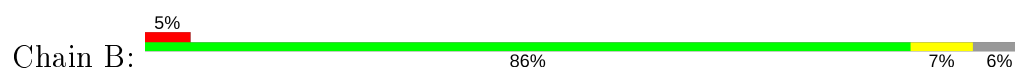
### 3 Residue-property plots [i](#)

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: Putative D-galactonate dehydratase



#### • Molecule 1: Putative D-galactonate dehydratase



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 4	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	117.34Å 117.34Å 113.69Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.30 47.64 – 2.29	Depositor EDS
% Data completeness (in resolution range)	94.5 (50.00-2.30) 94.2 (47.64-2.29)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.58 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, $R_{free}$	0.206 , 0.263 0.205 , 0.262	Depositor DCC
$R_{free}$ test set	1036 reflections (3.18%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.6	Xtriage
Anisotropy	0.458	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 71.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.000 for l,-k,h 0.000 for -l,-k,-h 0.000 for -h,-l,-k 0.000 for -h,l,k 0.027 for -k,-h,-l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5970	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.41% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: MG, CL

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	0/2962	0.55	0/4023
1	B	0.43	0/3024	0.57	0/4105
All	All	0.42	0/5986	0.56	0/8128

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	2891	0	2862	13	0
1	B	2939	0	2924	20	0
2	A	1	0	0	1	0
2	B	1	0	0	1	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	57	0	0	2	0
4	B	79	0	0	0	0
All	All	5970	0	5786	34	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 3.



All (34) 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:B:259:LEU:HD13	1:B:296:CYS:HA	1.75	0.67
1:A:226[A]:HIS:HE1	4:A:460:HOH:O	1.81	0.62
1:B:34:ILE:O	1:B:35:GLU:C	2.38	0.62
1:A:34:ILE:O	1:A:35:GLU:C	2.38	0.61
1:B:125:PRO:HG3	1:B:166[A]:ARG:HG3	1.90	0.53
1:B:12:PRO:HB2	1:B:13:PRO:HD3	1.90	0.53
1:B:11:LEU:HB3	1:B:12:PRO:HD2	1.92	0.52
1:B:33:VAL:HG13	1:B:260:SER:HB3	1.92	0.51
1:A:103:TYR:H	1:A:298:HIS:CD2	2.28	0.51
1:A:125:PRO:HG3	1:A:166:ARG:HG3	1.92	0.50
2:A:405:CL:CL	2:B:405:CL:CL	3.04	0.50
1:A:286:CYS:HB2	1:A:296:CYS:SG	2.52	0.49
1:B:125:PRO:HG3	1:B:166[B]:ARG:HG3	1.95	0.48
1:B:33:VAL:HG13	1:B:260:SER:CB	2.42	0.48
1:B:117:TYR:HE1	1:B:144:LYS:HB2	1.79	0.48
1:B:49[B]:SER:HA	1:B:52:LEU:HD12	1.97	0.47
1:A:284:PRO:HB2	1:A:309:GLN:HE22	1.80	0.45
1:B:286:CYS:SG	1:B:293:LEU:HA	2.57	0.45
1:B:6:LEU:HG	1:B:20:VAL:HG22	1.99	0.44
1:B:117:TYR:CE1	1:B:144:LYS:HB2	2.52	0.44
1:B:49[A]:SER:HA	1:B:52:LEU:HD12	1.99	0.44
1:A:288:LEU:HB3	1:A:289:GLY:H	1.53	0.44
1:B:300:ASP:OD1	1:B:309:GLN:NE2	2.49	0.44
1:A:140:PHE:HZ	1:A:335:LEU:HD13	1.83	0.44
1:A:96:LYS:NZ	4:A:443:HOH:O	2.47	0.43
1:B:12:PRO:C	1:B:14:ARG:H	2.22	0.43
1:A:52:LEU:HD23	1:A:63:LEU:HD22	2.00	0.43
1:A:369:ASN:HA	1:A:370:PRO:HD3	1.82	0.42
1:B:237:MET:HG2	1:B:242:ASP:HB3	2.01	0.42
1:A:300:ASP:OD1	1:A:309:GLN:NE2	2.52	0.42
1:B:1:VAL:HG13	1:B:24:GLU:HG3	2.02	0.42
1:A:49:SER:HA	1:A:52:LEU:HD12	2.02	0.41
1:B:11:LEU:HA	1:B:12:PRO:HD3	1.93	0.40
1:B:6:LEU:HD23	1:B:18:LEU:HD21	2.03	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	369/405 (91%)	354 (96%)	12 (3%)	3 (1%)	19	23
1	B	379/405 (94%)	369 (97%)	10 (3%)	0	100	100
All	All	748/810 (92%)	723 (97%)	22 (3%)	3 (0%)	34	42

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	13	PRO
1	A	287	PRO
1	A	12	PRO

### 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	294/323 (91%)	280 (95%)	14 (5%)	25	36
1	B	299/323 (93%)	292 (98%)	7 (2%)	50	67
All	All	593/646 (92%)	572 (96%)	21 (4%)	35	50

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	GLU
1	A	35	GLU
1	A	118	SER

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Mol	Chain	Res	Type
1	A	124	ARG
1	A	153	ILE
1	A	155	ASP
1	A	213	LEU
1	A	238	PHE
1	A	240	ARG
1	A	286	CYS
1	A	323	LEU
1	A	350	VAL
1	A	356	LEU
1	A	379	VAL
1	B	148	CYS
1	B	204	ARG
1	B	259	LEU
1	B	261	HIS
1	B	286	CYS
1	B	350	VAL
1	B	356	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	285	HIS
1	A	298	HIS
1	A	309	GLN
1	A	369	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 monosaccharides in this entry.

## 5.6 Ligand geometry

Of 4 ligands modelled in this entry, 4 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	374/405 (92%)	0.15	9 (2%) 59 66	39, 66, 100, 119	0
1	B	379/405 (93%)	0.19	22 (5%) 23 29	26, 61, 97, 131	0
All	All	753/810 (92%)	0.17	31 (4%) 37 44	26, 64, 99, 131	0

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	324	LEU	6.1
1	B	324	LEU	5.6
1	B	323	LEU	5.2
1	B	288	LEU	4.5
1	B	385	ASN	4.0
1	B	14	ARG	3.7
1	A	365	PRO	3.2
1	A	151	MET	3.2
1	B	73	TYR	3.2
1	B	386	LEU	3.2
1	B	365	PRO	3.0
1	B	241	PHE	2.9
1	A	241	PHE	2.8
1	B	326	TYR	2.8
1	B	321	ALA	2.7
1	A	323	LEU	2.7
1	B	17	PHE	2.7
1	B	11	LEU	2.6
1	B	366	ASP	2.6
1	B	0	MET	2.6
1	B	214	ALA	2.5
1	B	246	VAL	2.4
1	B	217	ALA	2.3
1	A	130	ALA	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	327	VAL	2.3
1	B	277	ALA	2.3
1	B	322	GLU	2.2
1	B	261	HIS	2.2
1	A	384	GLU	2.1
1	A	12	PRO	2.0
1	A	238	PHE	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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
3	MG	A	406	1/1	0.76	0.07	83,83,83,83	0
3	MG	B	406	1/1	0.83	0.12	96,96,96,96	0
2	CL	A	405	1/1	0.90	0.10	68,68,68,68	0
2	CL	B	405	1/1	0.97	0.10	72,72,72,72	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.