

# wwPDB X-ray Structure Validation Summary Report (i)

#### Oct 7, 2023 – 06:36 PM EDT

PDB ID : 6DOK

Title : Crystal Structure of Bacillus Halodurans Ribonuclease H1 in Complex with

an RNA/DNA Hybrid: Reaction in 2 mM Mg2+ and 25 mM K+ for 120 s at

21 C (dataset 1)

Authors : Samara, N.L.; Yang, W.

Deposited on : 2018-06-09

Resolution : 1.38 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 (i) 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 (i)) were used in the production of this report:

MolProbity: 4.02b-467

Mogul : 1.8.5 (274361), CSD as541be (2020)

Xtriage (Phenix) : 1.13

EDS : 2.35.1

buster-report : 1.1.7 (2018)

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)

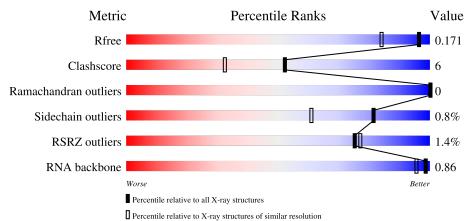
Validation Pipeline (wwPDB-VP) : 2.35.1

## 1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure: X- $RAY\ DIFFRACTION$ 

The reported resolution of this entry is 1.38 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 $(\# \mathrm{Entries})$	$\begin{array}{c} {\rm Similar\ resolution} \\ (\#{\rm Entries},{\rm resolution\ range}(\mathring{\rm A})) \end{array}$
$R_{free}$	130704	2907 (1.40-1.36)
Clashscore	141614	3037 (1.40-1.36)
Ramachandran outliers	138981	2970 (1.40-1.36)
Sidechain outliers	138945	2969 (1.40-1.36)
RSRZ outliers	127900	2846 (1.40-1.36)
RNA backbone	3102	1000 (2.34-0.62)

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 <=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	135	90% 10%	
2	В	4	100%	
3	b	2	100%	

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Mol	Chain	Length	Quality of chain						
		_							
4	С	6	83%	17%					

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
7	IOD	A	205	-	-	X	-
8	GOL	A	211	-	-	X	-



# 2 Entry composition (i)

There are 10 unique types of molecules in this entry. The entry contains 2478 atoms, of which 865 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 Ribonuclease H.

Mol	Chain	Residues		Atoms						AltConf	Trace
1	A	135	Total 1997	C 727	H 865	N 187	O 216	S 2	0	5	0

• Molecule 2 is a RNA chain called 5'-R(\*AP\*CP\*AP\*U)-3' portion of intact RNA (5'-R(\*AP\*CP\*AP\*UP\*CP\*G)-3').

Mol	Chain	Residues	${f Atoms}$			ZeroOcc	AltConf	Trace		
2	D	4	Total	С	N	О	Р	0	0	0
	Б	4	80	38	15	24	3	0	0	U

• Molecule 3 is a RNA chain called 5'-R(P\*CP\*G)-3' portion of intact RNA (5'-R(\*AP\*CP\*AP\*UP\*CP\*G)-3').

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace		
3	h	9	Total	С	N	О	Р	0	0	0
'	D	2	42	19	8	13	2	0		

• Molecule 4 is a DNA chain called DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*T)-3').

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace		
4	С	6	Total 121	C 59	N 22	O 35	P 5	0	0	0

• Molecule 5 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	2	Total Mg 2 2	0	0

• Molecule 6 is POTASSIUM ION (three-letter code: K) (formula: K) (labeled as "Ligand of Interest" by depositor).

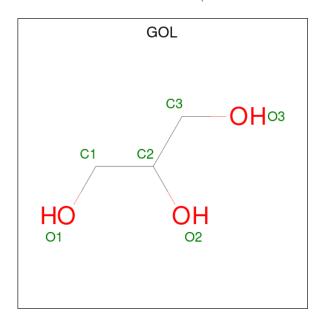


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total K 1 1	0	0

• Molecule 7 is IODIDE ION (three-letter code: IOD) (formula: I).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	2	Total I 2 2	0	0

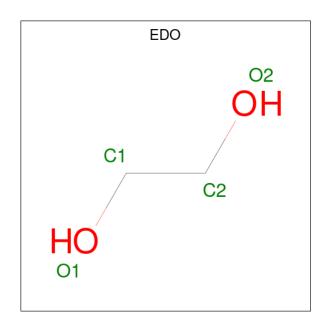
 $\bullet$  Molecule 8 is GLYCEROL (three-letter code: GOL) (formula:  $\mathrm{C_3H_8O_3}).$ 



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total C O 6 3 3	0	0
8	A	1	Total C O 6 3 3	0	0
8	A	1	Total C O 6 3 3	0	0
8	A	1	Total C O 6 3 3	0	0

 $\bullet$  Molecule 9 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula:  $\mathrm{C_2H_6O_2}).$ 





Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	1	Total C O 4 2 2	0	0
9	A	1	Total C O 4 2 2	0	0

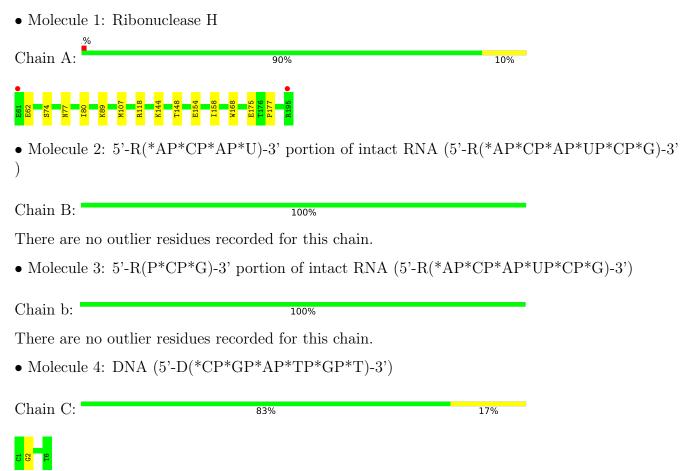
#### • Molecule 10 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	162	Total O 162 162	0	0
10	В	12	Total O 12 12	0	0
10	b	8	Total O 8 8	0	0
10	С	19	Total O 19 19	0	1



## 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.





# 4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants	81.62Å 37.43Å 62.25Å	Donositon
a, b, c, $\alpha$ , $\beta$ , $\gamma$	90.00° 96.58° 90.00°	Depositor
Resolution (Å)	19.95 - 1.38	Depositor
Resolution (A)	19.95 - 1.38	EDS
% Data completeness	94.4 (19.95-1.38)	Depositor
(in resolution range)	94.4 (19.95-1.38)	EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$< I/\sigma(I) > 1$	1.54 (at 1.38Å)	Xtriage
Refinement program	PHENIX 1.10_2155	Depositor
D D.	0.149 , 0.170	Depositor
$R, R_{free}$	0.150 , $0.171$	DCC
$R_{free}$ test set	1830 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.5	Xtriage
Anisotropy	0.318	Xtriage
Bulk solvent $k_{sol}(e/Å^3)$ , $B_{sol}(Å^2)$	0.45 , 74.0	EDS
L-test for twinning <sup>2</sup>	$ < L >=0.49, < L^2>=0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.98	EDS
Total number of atoms	2478	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: The largest off-origin peak in the Patterson function is 9.51% of the height of the origin peak. No significant pseudotranslation is detected.

<sup>&</sup>lt;sup>2</sup>Theoretical values of <|L|>,  $<L^2>$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.



<sup>&</sup>lt;sup>1</sup>Intensities estimated from amplitudes.

## 5 Model quality (i)

### 5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, EDO, MG, IOD, K

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	
IVIOI		RMSZ	# Z  > 5	RMSZ	# Z  > 5
1	A	0.40	0/1173	0.60	0/1587
2	В	0.63	0/89	1.11	0/136
3	b	0.58	0/46	1.04	0/69
4	С	0.97	0/135	1.14	0/207
All	All	0.50	0/1443	0.73	0/1999

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 (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	1132	865	1132	12	1
2	В	80	0	44	0	0
3	b	42	0	23	0	0
4	С	121	0	70	1	0
5	A	2	0	0	0	0
6	A	1	0	0	0	0
7	A	2	0	0	2	0
8	A	24	0	32	6	0
9	A	8	0	12	2	0

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	.,	10	1

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
10	A	162	0	0	3	3
10	В	12	0	0	0	0
10	С	19	0	0	0	0
10	b	8	0	0	0	0
All	All	1613	865	1313	15	3

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 6.

The worst 5 of 15 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	$\begin{array}{c} \text{Interatomic} \\ \text{distance (Å)} \end{array}$	$\begin{array}{c} \text{Clash} \\ \text{overlap } (\text{\AA}) \end{array}$
1:A:148:THR:HG21	8:A:211:GOL:H11	1.47	0.95
1:A:148:THR:CG2	8:A:211:GOL:H11	2.12	0.79
1:A:154:GLU:OE2	10:A:301:HOH:O	2.10	0.68
1:A:148:THR:HG21	8:A:211:GOL:C1	2.24	0.61
8:A:211:GOL:H12	10:A:379:HOH:O	2.02	0.59

All (3) 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	$\begin{array}{c} {\rm Interatomic} \\ {\rm distance} \ ({\rm \AA}) \end{array}$	Clash overlap (Å)
10:A:416:HOH:O	10:A:416:HOH:O[2_656]	1.76	0.44
10:A:410:HOH:O	10:A:458:HOH:O[3_545]	2.10	0.10
1:A:175[A]:GLU:OE2	10:A:416:HOH:O[2_656]	2.17	0.03

### 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	Perce	entiles
1	A	138/135 (102%)	138 (100%)	0	0	100	100



There are no Ramachandran outliers to report.

#### 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	124/119 (104%)	123 (99%)	1 (1%)	81 61

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	62	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

#### 5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	В	2/4 (50%)	0	0
3	b	0/2	-	-
All	All	2/6 (33%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

## 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 (i)

Of 11 ligands modelled in this entry, 5 are monoatomic - leaving 6 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 Re		Res	es Link	Bond lengths			Bond angles			
MIOI	Type	Chain	nes	nes   Link	Counts	RMSZ	# Z >2	Counts	RMSZ	# Z  > 2
9	EDO	A	209	-	3,3,3	0.51	0	2,2,2	0.29	0
8	GOL	A	208	-	5,5,5	0.35	0	5,5,5	0.29	0
8	GOL	A	207	-	5,5,5	0.36	0	5,5,5	0.25	0
8	GOL	A	206	-	5,5,5	0.34	0	5,5,5	0.26	0
8	GOL	A	211	-	5,5,5	0.36	0	5,5,5	0.32	0
9	EDO	A	210	-	3,3,3	0.45	0	2,2,2	0.40	0

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
9	EDO	A	209	-	-	0/1/1/1	-
8	GOL	A	208	-	-	0/4/4/4	-
8	GOL	A	207	-	-	3/4/4/4	-
8	GOL	A	206	-	-	2/4/4/4	-
8	GOL	A	211	-	-	2/4/4/4	-
9	EDO	A	210	-	-	0/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 7 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	A	206	GOL	O1-C1-C2-C3
8	A	207	GOL	O1-C1-C2-C3
8	A	206	GOL	O1-C1-C2-O2

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Mol	Chain	Res	Type	Atoms
8	A	207	GOL	O1-C1-C2-O2
8	A	211	GOL	O1-C1-C2-O2

There are no ring outliers.

3 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	A	206	GOL	2	0
8	A	211	GOL	4	0
9	A	210	EDO	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,  $95^{th}$  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	$\langle { m RSRZ} \rangle$	# RSRZ > 2	$OWAB(A^2)$	Q < 0.9
1	A	135/135 (100%)	-0.24	2 (1%) 73 75	16, 27, 52, 83	2 (1%)
2	В	4/4 (100%)	-0.45	0 100 100	25, 26, 43, 46	0
3	b	2/2 (100%)	-0.64	0 100 100	26, 26, 26, 34	0
4	С	6/6 (100%)	-0.00	0 100 100	25, 32, 46, 51	0
All	All	147/147 (100%)	-0.24	2 (1%) 75 77	16, 27, 51, 83	2 (1%)

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	61	GLU	3.9
1	A	195	ARG	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 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,  $95^{th}$  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.



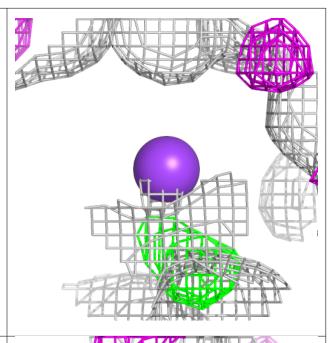
Mol	Type	Chain	Res	Atoms	RSCC	RSR	$\mathbf{B} ext{-}\mathbf{factors}(\mathbf{\mathring{A}}^2)$	Q<0.9
9	EDO	A	210	4/4	0.59	0.27	79,80,80,82	0
9	EDO	A	209	4/4	0.70	0.15	51,53,56,57	0
8	GOL	A	206	6/6	0.72	0.14	60,63,63,65	0
8	GOL	A	207	6/6	0.78	0.16	71,74,75,76	0
8	GOL	A	208	6/6	0.81	0.15	68,68,68,69	0
8	GOL	A	211	6/6	0.91	0.15	31,51,145,157	0
6	K	A	203	1/1	0.93	0.16	32,32,32,32	1
7	IOD	A	205	1/1	0.98	0.06	47,47,47,47	1
5	MG	A	201	1/1	0.99	0.08	26,26,26,26	0
5	MG	A	202	1/1	0.99	0.04	25,25,25,25	0
7	IOD	A	204	1/1	1.00	0.02	33,33,33,33	1

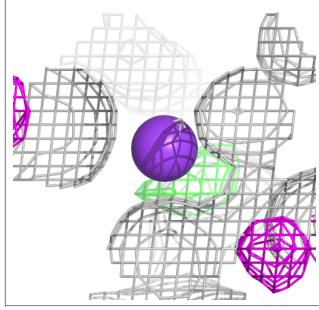
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

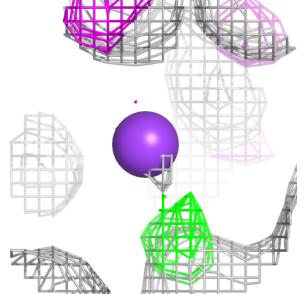


#### Electron density around K A 203:

 $2 {
m mF}_o {
m -DF}_c$  (at 0.7 rmsd) in gray  ${
m mF}_o {
m -DF}_c$  (at 3 rmsd) in purple (negative) and green (positive)



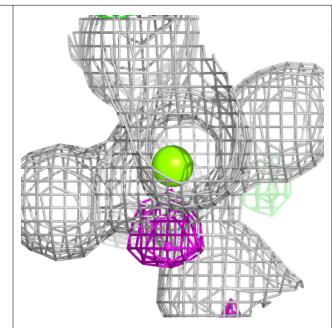


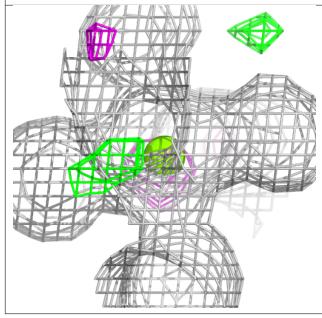


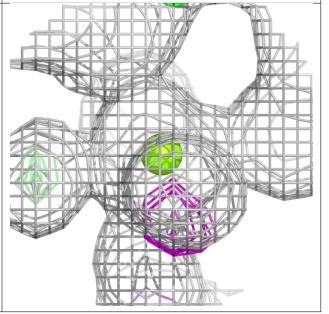


#### Electron density around MG A 201:

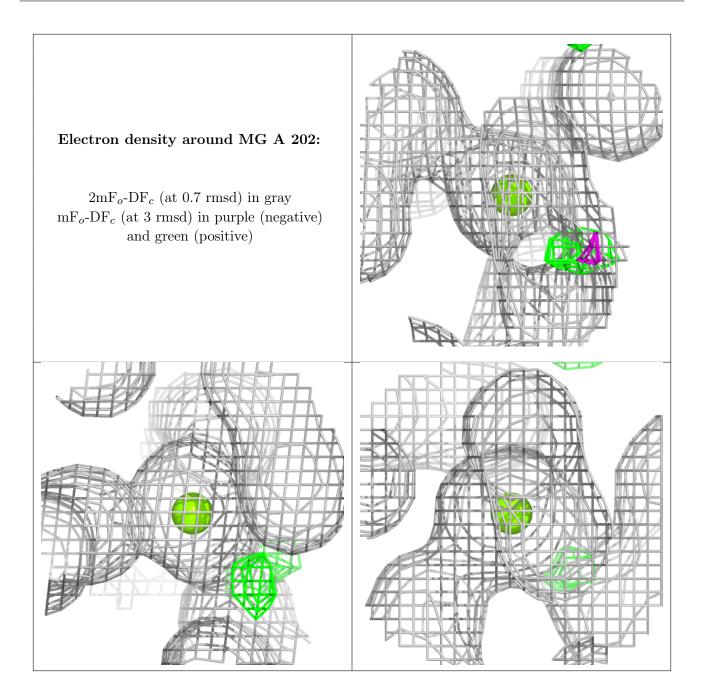
 $2 {
m mF}_o {
m -DF}_c$  (at 0.7 rmsd) in gray  ${
m mF}_o {
m -DF}_c$  (at 3 rmsd) in purple (negative) and green (positive)











## 6.5 Other polymers (i)

There are no such residues in this entry.

