



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 26, 2014 – 03:07 PM GMT

PDB ID : 2A8R  
Title : 2.45 Angstrom Crystal Structure of the Complex Between the Nuclear  
SnoRNA Decapping Nudix Hydrolase X29 and Manganese in the Presence  
of 7-methyl-GTP  
Authors : Scarsdale, J.N.; Peculis, B.A.; Wright, H.T.  
Deposited on : 2005-07-08  
Resolution : 2.45 Å(reported)

This is a full wwPDB 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 <http://wwpdb.org/ValidationPDFNotes.html>

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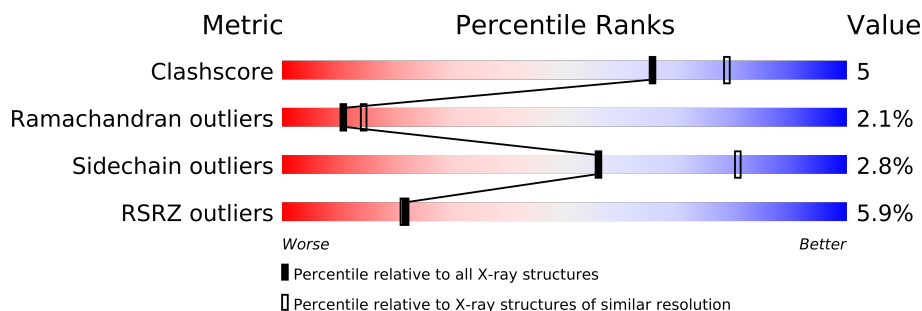
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 2.45 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))
Clashscore	79885	4471 (2.50-2.42)
Ramachandran outliers	78287	4383 (2.50-2.42)
Sidechain outliers	78261	4385 (2.50-2.42)
RSRZ outliers	66119	3568 (2.50-2.42)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	212	
1	B	212	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
3	POP	A	1307	-	X
3	POP	B	2308	-	X

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3014 atoms, of which 0 are hydrogen and 0 are deuterium.

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 U8 snoRNA-binding protein X29.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	190	Total	C	N	O	S	0	0	0
			1389	873	248	261	7			
1	B	191	Total	C	N	O	S	0	3	0
			1529	965	272	285	7			

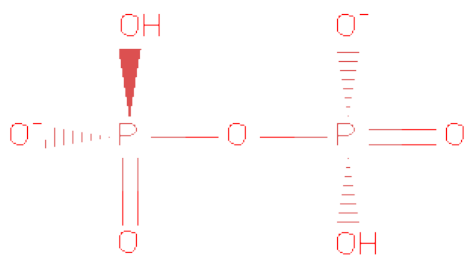
There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	120	YCM	CYS	MODIFIED RESIDUE	UNP Q569R2
A	174	YCM	CYS	MODIFIED RESIDUE	UNP Q569R2
B	120	YCM	CYS	MODIFIED RESIDUE	UNP Q569R2
B	174	YCM	CYS	MODIFIED RESIDUE	UNP Q569R2

- Molecule 2 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	2	Total	Mn	0	0
			2	2		
2	A	3	Total	Mn	0	0
			3	3		

- Molecule 3 is PYROPHOSPHATE 2- (three-letter code: POP) (formula: H<sub>2</sub>O<sub>7</sub>P<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	P	0	0
			9	7	2		
3	B	1	Total	O	P	0	0
			9	7	2		

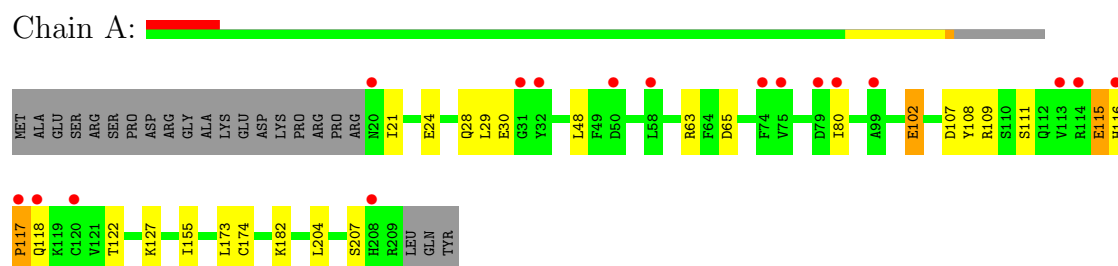
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	19	Total	O	0	0
			19	19		
4	B	54	Total	O	0	0
			54	54		

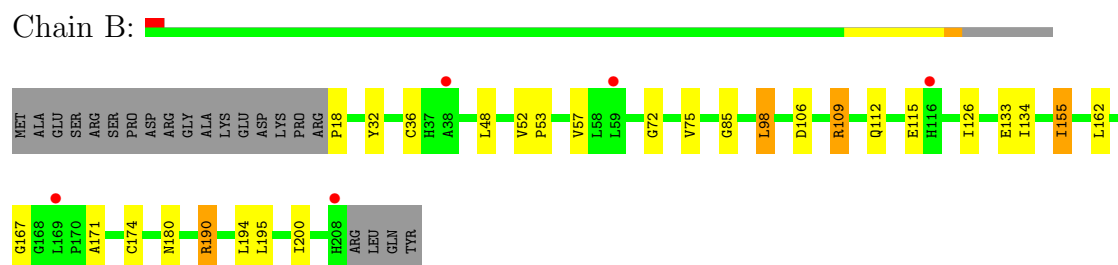
### 3 Residue-property plots i

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 ( $RSRZ > 2$ ). 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: U8 snoRNA-binding protein X29



- Molecule 1: U8 snoRNA-binding protein X29



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	50.20Å 82.15Å 112.24Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	23.00 – 2.45 22.10 – 2.45	Depositor EDS
% Data completeness (in resolution range)	99.4 (23.00-2.45) 99.4 (22.10-2.45)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.42 (at 2.44Å)	Xtriage
Refinement program	REFMAC 5.2	Depositor
R, $R_{free}$	0.222 , 0.263 0.235 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	DCC
Wilson B-factor (Å <sup>2</sup> )	58.0	Xtriage
Anisotropy	0.427	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 72.4	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.52$ , $\langle L^2 \rangle = 0.36$	Xtriage
Outliers	2 of 17559 reflections (0.011%)	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	3014	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.42% of the height of the origin peak. No significant pseudotranslation is detected.*

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

## 5 Model quality ⓘ

### 5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MN, POP, YCM

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	1.18	2/1392 (0.1%)	0.65	2/1886 (0.1%)
1	B	0.52	0/1537	0.61	1/2070 (0.0%)
All	All	0.90	2/2929 (0.1%)	0.63	3/3956 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	115	GLU	CD-OE2	37.23	1.66	1.25
1	A	115	GLU	CD-OE1	15.23	1.42	1.25

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	115	GLU	OE1-CD-OE2	7.04	131.75	123.30
1	A	117	PRO	N-CA-CB	6.83	111.49	103.30
1	B	18	PRO	N-CA-CB	6.70	111.34	103.30

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1389	0	1270	12	0
1	B	1529	0	1514	19	0
2	A	3	0	0	0	0
2	B	2	0	0	0	0
3	A	9	0	0	0	0
3	B	9	0	0	0	0
4	A	19	0	0	0	0
4	B	54	0	0	1	0
All	All	3014	0	2784	30	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 5.

All (30) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:115:GLU:OE2	1:A:115:GLU:CD	1.66	1.30
1:B:112:GLN:NE2	1:B:180[A]:ASN:HD21	1.76	0.84
1:B:112:GLN:HE21	1:B:180[A]:ASN:HD21	1.24	0.82
1:B:112:GLN:HE21	1:B:180[A]:ASN:ND2	1.94	0.63
1:B:112:GLN:NE2	1:B:180[A]:ASN:ND2	2.46	0.61
1:A:111:SER:HA	1:A:122:THR:O	2.02	0.60
1:B:190:ARG:HG2	1:B:200:ILE:HD12	1.89	0.54
1:B:98:LEU:HB3	4:B:2350:HOH:O	2.10	0.51
1:A:102:GLU:O	1:A:127:LYS:HE2	2.12	0.50
1:A:173:LEU:HB3	1:A:182:LYS:HE3	1.93	0.50
1:B:171:ALA:O	1:B:174:YCM:HB3	2.13	0.49
1:B:190:ARG:HG2	1:B:200:ILE:CD1	2.44	0.47
1:A:155:ILE:CG2	1:B:155:ILE:HD11	2.46	0.46
1:B:109:ARG:HG2	1:B:126:ILE:HD12	1.99	0.45
1:B:162:LEU:HD12	1:B:167:GLY:HA3	2.00	0.44
1:A:115:GLU:HB2	1:A:115:GLU:OE2	2.17	0.44
1:B:75:VAL:HG13	1:B:85:GLY:HA3	1.98	0.44
1:A:63:ARG:HB2	1:A:65:ASP:OD1	2.18	0.43
1:A:107:ASP:OD1	1:A:127:LYS:HD2	2.19	0.42
1:A:115:GLU:CG	1:A:115:GLU:OE2	2.61	0.42
1:A:174:YCM:HD2	1:A:207:SER:O	2.20	0.42
1:B:48:LEU:N	1:B:52:VAL:O	2.50	0.42
1:B:32:TYR:OH	1:B:115:GLU:OE2	2.27	0.42
1:B:57:VAL:HG11	1:B:134:ILE:HG21	2.02	0.41
1:B:52:VAL:HA	1:B:53:PRO:HD3	1.94	0.40
1:A:108:TYR:O	1:A:109:ARG:HD2	2.21	0.40
1:A:204:LEU:HA	1:A:207:SER:HB3	2.03	0.40
1:B:194:LEU:C	1:B:195:LEU:HD12	2.42	0.40

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:36:CYS:O	1:B:72:GLY:HA3	2.21	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	186/212 (88%)	166 (89%)	12 (6%)	8 (4%)	4	4
1	B	190/212 (90%)	182 (96%)	8 (4%)	0	100	100
All	All	376/424 (89%)	348 (93%)	20 (5%)	8 (2%)	11	14

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	21	ILE
1	A	80	ILE
1	A	116	HIS
1	A	117	PRO
1	A	118	GLN
1	A	30	GLU
1	A	48	LEU
1	A	29	LEU

### 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	126/183 (69%)	123 (98%)	3 (2%)	61	84

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	B	159/183 (87%)	154 (97%)	5 (3%)	52 77
All	All	285/366 (78%)	277 (97%)	8 (3%)	56 81

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	GLU
1	A	28	GLN
1	A	102	GLU
1	B	98	LEU
1	B	106	ASP
1	B	109	ARG
1	B	155	ILE
1	B	190	ARG

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

Mol	Chain	Res	Type
1	B	112	GLN

### 5.3.3 RNA ⓘ

There are no RNA chains in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

4 non-standard protein/DNA/RNA residues are modelled in this entry.

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	$\# Z  > 2$
1	YCM	A	120	1	5,5,10	7.99	2 (40%)	2,5,12	0.82	0
1	YCM	A	174	1	9,9,10	5.80	3 (33%)	8,10,12	1.58	2 (25%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
1	YCM	B	120	1	9,9,10	6.19	3 (33%)	8,10,12	1.10	0
1	YCM	B	174	1	9,9,10	5.70	4 (44%)	8,10,12	1.60	2 (25%)

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
1	YCM	A	120	1	-	0/2/4/10	0/0/0/0
1	YCM	A	174	1	-	0/6/8/10	0/0/0/0
1	YCM	B	120	1	-	0/6/8/10	0/0/0/0
1	YCM	B	174	1	-	0/6/8/10	0/0/0/0

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	120	YCM	O-C	18.13	1.23	1.11
1	A	120	YCM	O-C	17.67	1.23	1.11
1	A	174	YCM	O-C	16.96	1.23	1.11
1	B	174	YCM	O-C	16.64	1.22	1.11
1	A	174	YCM	CB-SG	-2.63	1.75	1.81
1	B	120	YCM	CD-SG	-2.60	1.76	1.81
1	A	120	YCM	CA-C	2.52	1.53	1.48
1	B	120	YCM	CA-C	2.48	1.52	1.48
1	B	174	YCM	CD-SG	-2.46	1.77	1.81
1	A	174	YCM	CA-C	2.38	1.52	1.48
1	B	174	YCM	CB-SG	-2.16	1.76	1.81
1	B	174	YCM	CA-C	2.05	1.52	1.48

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	174	YCM	C-CA-N	-3.64	110.19	113.83
1	A	174	YCM	CB-SG-CD	3.26	107.27	101.94
1	A	174	YCM	CA-CB-SG	-2.14	107.45	112.82
1	B	174	YCM	CB-SG-CD	-2.09	98.53	101.94

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 5.5 Carbohydrates

There are no carbohydrates in this entry.

## 5.6 Ligand geometry

Of 7 ligands modelled in this entry, 5 are monoatomic - leaving 2 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	POP	A	1307	2	8,8,8	0.43	0	13,13,13	1.16	2 (15%)
3	POP	B	2308	2	8,8,8	0.45	0	13,13,13	1.31	1 (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	POP	A	1307	2	-	0/6/6/6	0/0/0/0
3	POP	B	2308	2	-	0/6/6/6	0/0/0/0

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	2308	POP	P2-O-P1	-3.56	121.04	131.74
3	A	1307	POP	P2-O-P1	-2.85	123.18	131.74
3	A	1307	POP	O2-P1-O	2.01	110.69	104.29

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 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	190/212 (89%)	0.34	17 (8%) 10 9	53, 62, 78, 89	0
1	B	191/212 (90%)	0.04	5 (2%) 53 54	50, 61, 73, 87	0
All	All	381/424 (89%)	0.19	22 (5%) 22 22	50, 62, 78, 89	0

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	31	GLY	8.5
1	A	32	TYR	3.8
1	A	79	ASP	3.5
1	A	75	VAL	3.5
1	A	99	ALA	3.5
1	A	113	VAL	3.4
1	A	117	PRO	3.3
1	A	80	ILE	2.9
1	A	208	HIS	2.8
1	A	114	ARG	2.8
1	A	116	HIS	2.6
1	B	59	LEU	2.5
1	B	169	LEU	2.5
1	B	38	ALA	2.4
1	B	116	HIS	2.4
1	B	208	HIS	2.4
1	A	120	YCM	2.3
1	A	74	PHE	2.3
1	A	58	LEU	2.3
1	A	118	GLN	2.2
1	A	50	ASP	2.2
1	A	20	ASN	2.1

## 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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, 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	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
1	YCM	B	174	10/11	0.18	0.70	63,66,76,78	0
1	YCM	A	120	6/11	0.30	0.40	75,77,79,81	0
1	YCM	A	174	10/11	0.16	0.27	56,61,81,81	0
1	YCM	B	120	10/11	0.17	-0.60	67,71,109,112	0

## 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands ⓘ

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, 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	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
3	POP	B	2308	9/9	0.20	2.83	50,57,60,63	9
3	POP	A	1307	9/9	0.26	2.10	41,50,53,59	9
2	MN	A	302	1/1	0.30	1.78	75,75,75,75	1
2	MN	A	301	1/1	0.08	-1.52	72,72,72,72	0
2	MN	B	305	1/1	0.07	-2.65	74,74,74,74	0
2	MN	B	304	1/1	0.06	-3.51	80,80,80,80	0
2	MN	A	300	1/1	0.04	-4.97	69,69,69,69	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.