



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 27, 2026 – 06:21 PM EDT

PDB ID : 2Q3H / pdb_00002q3h
Title : The crystal structure of RhouA in the GDP-bound state.
Authors : Gileadi, C.; Yang, X.; Papagrigoriou, E.; Elkins, J.; Zhao, Y.; Bray, J.; Gileadi, O.; Umeano, C.; Ugochukwu, E.; Uppenberg, J.; Bunkoczi, G.; von Delft, F.; Pike, A.C.W.; Phillips, C.; Savitsky, P.; Fedorov, O.; Edwards, A.; Weigelt, J.; Arrowsmith, C.H.; Sundstrom, M.; Doyle, D.A.; Structural Genomics Consortium (SGC)
Deposited on : 2007-05-30
Resolution : 1.73 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

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)

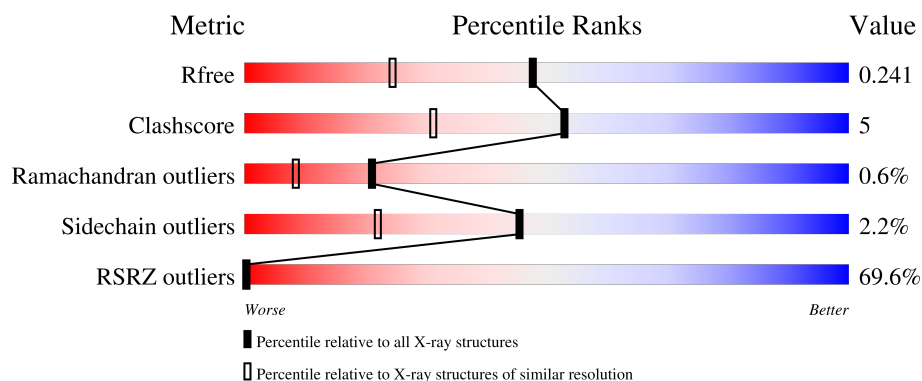
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.73 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}	180053	1187 (1.74-1.74)
Clashscore	190562	1207 (1.74-1.74)
Ramachandran outliers	187476	1200 (1.74-1.74)
Sidechain outliers	187428	1200 (1.74-1.74)
RSRZ outliers	180081	1188 (1.74-1.74)

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 $\leq 5\%$. 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	201	59% 77% 6% 15%

Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 1439 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 Ras homolog gene family, member U.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	171	Total	C	N	O	S	0	3	0
			1284	819	205	251	9			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	30	SER	-	cloning artifact	UNP Q9NPY5
A	31	MET	-	cloning artifact	UNP Q9NPY5
A	191	LEU	CYS	conflict	UNP Q9NPY5

- Molecule 2 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

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

- Molecule 3 is GUANOSINE-5'-DIPHOSPHATE (CCD ID: GDP) (formula: C₁₀H₁₅N₅O₁₁P₂).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			28	10	5	11	2		

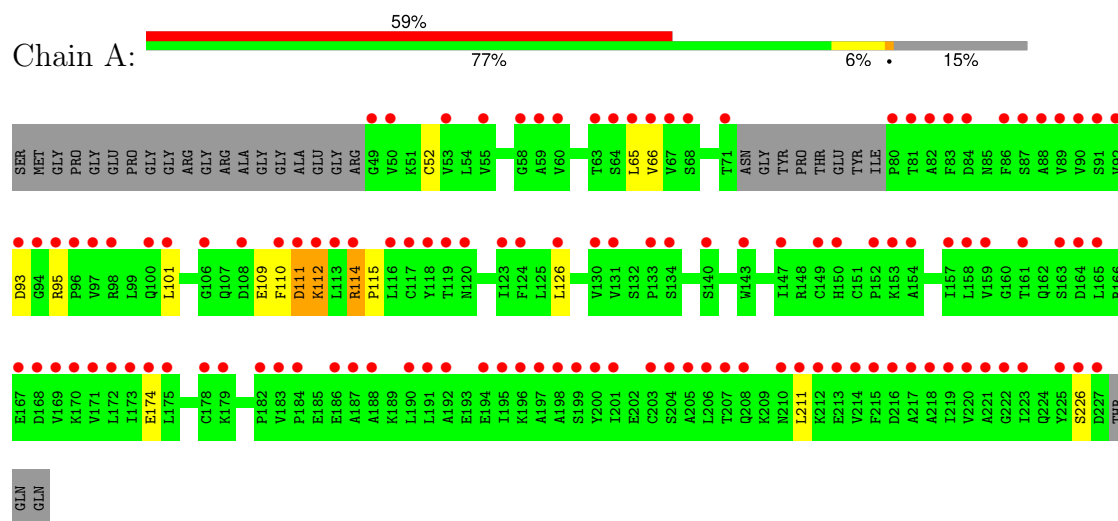
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	124	Total O 126 126	0	2

3 Residue-property plots

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: Ras homolog gene family, member U



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	82.07Å 53.60Å 54.13Å 90.00° 118.80° 90.00°	Depositor
Resolution (Å)	47.46 – 1.73 47.43 – 1.73	Depositor EDS
% Data completeness (in resolution range)	99.6 (47.46-1.73) 99.6 (47.43-1.73)	Depositor EDS
R_{merge}	0.03	Depositor
R_{sym}	0.05	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.48 (at 1.73Å)	Xtriage
Refinement program	REFMAC 5.3.0034	Depositor
R, R_{free}	0.183 , 0.222 0.205 , 0.241	Depositor DCC
R_{free} test set	1107 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å ²)	31.4	Xtriage
Anisotropy	0.095	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 48.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	1439	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.72% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MG, GDP

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	0.88	1/1316 (0.1%)	0.94	1/1792 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	114	ARG	NE-CZ	5.26	1.38	1.33

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	114	ARG	NE-CZ-NH2	5.76	124.38	119.20

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	111	ASP	Peptide

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	1284	0	1262	13	0
2	A	1	0	0	0	0
3	A	28	0	12	0	0
4	A	126	0	0	2	0
All	All	1439	0	1274	13	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 5.

All (13) 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:65:LEU:HD12	1:A:211:LEU:CD1	2.01	0.89
1:A:65:LEU:HD12	1:A:211:LEU:HD11	1.62	0.79
1:A:66[B]:VAL:HG13	1:A:101:LEU:HD13	1.78	0.64
1:A:110:PHE:C	1:A:112:LYS:H	2.06	0.63
1:A:65:LEU:CD1	1:A:211:LEU:CD1	2.77	0.61
1:A:110:PHE:C	1:A:112:LYS:N	2.58	0.58
1:A:52:CYS:HB3	1:A:101:LEU:HD23	1.92	0.52
1:A:111:ASP:HA	1:A:115:PRO:HD3	1.92	0.51
1:A:93:ASP:OD1	4:A:3556[A]:HOH:O	2.20	0.48
1:A:66[B]:VAL:HG13	1:A:101:LEU:CD1	2.45	0.46
1:A:174:GLU:HG2	4:A:3447:HOH:O	2.19	0.43
1:A:114:ARG:HB3	1:A:115:PRO:HD3	2.01	0.42
1:A:126:LEU:HD23	1:A:126:LEU:C	2.46	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	170/201 (85%)	166 (98%)	3 (2%)	1 (1%)	21 8

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	112	LYS

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	142/168 (84%)	139 (98%)	3 (2%)	47 24

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	95	ARG
1	A	109	GLU
1	A	226	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	100	GLN
1	A	138	ASN
1	A	208	GLN

5.3.3 RNA ⓘ

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	GDP	A	3444	2	29,30,30	1.64	4 (13%)	45,47,47	1.66	5 (11%)

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	GDP	A	3444	2	-	0/16/32/32	0/3/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	3444	GDP	PA-O3A	-4.70	1.54	1.59
3	A	3444	GDP	C6-N1	-4.01	1.31	1.38
3	A	3444	GDP	C5-C4	2.98	1.46	1.38
3	A	3444	GDP	C8-N7	2.70	1.40	1.32

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	3444	GDP	C5-C4-N3	-5.07	120.33	128.39
3	A	3444	GDP	N9-C4-N3	4.74	135.42	125.95
3	A	3444	GDP	C2-N3-C4	4.63	120.28	112.30
3	A	3444	GDP	O2A-PA-O3A	3.53	116.82	107.27
3	A	3444	GDP	O6-C6-C5	-2.61	119.65	126.53

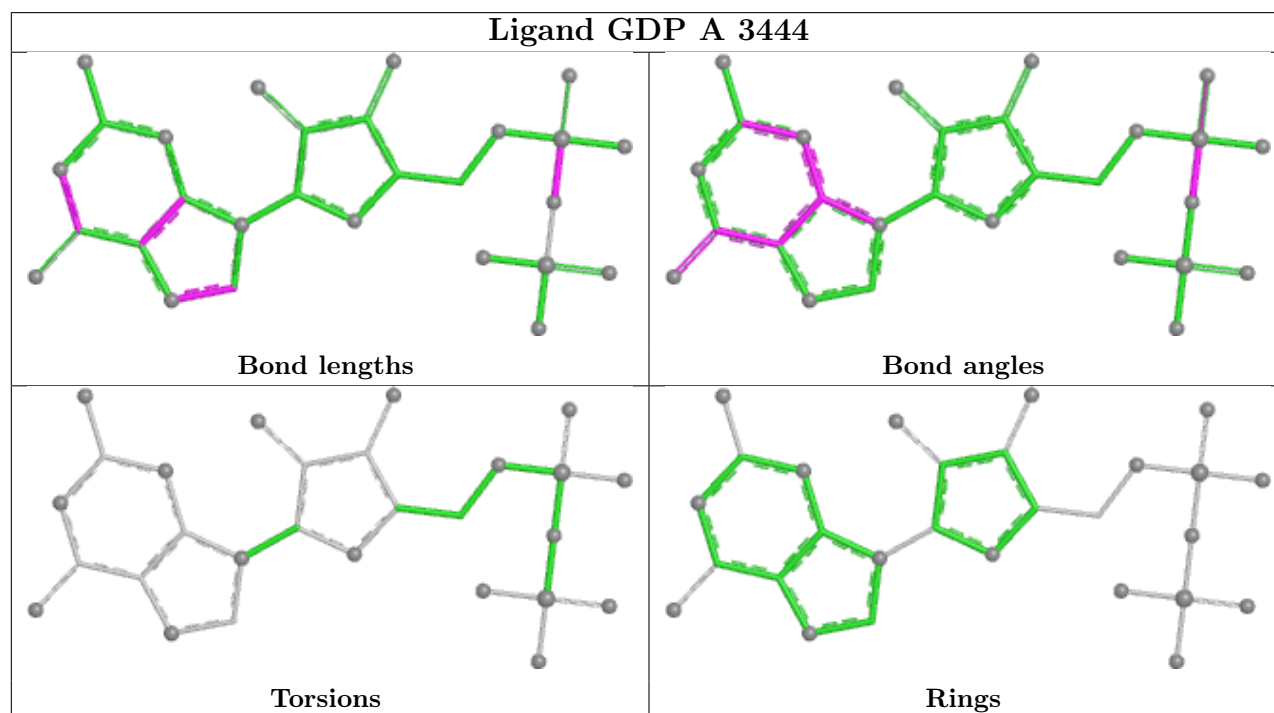
There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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

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	171/201 (85%)	2.79	119 (69%) 0 0	28, 44, 56, 69	3 (1%)

All (119) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	222	GLY	7.4
1	A	80	PRO	6.8
1	A	221	ALA	6.6
1	A	218	ALA	6.5
1	A	82	ALA	6.3
1	A	192	ALA	5.8
1	A	89	VAL	5.6
1	A	171	VAL	5.6
1	A	217	ALA	5.3
1	A	214	VAL	5.3
1	A	226	SER	5.2
1	A	49	GLY	5.1
1	A	169	VAL	5.1
1	A	216	ASP	5.0
1	A	219	ILE	4.7
1	A	223	ILE	4.6
1	A	116	LEU	4.6
1	A	212	LYS	4.6
1	A	83	PHE	4.5
1	A	215	PHE	4.4
1	A	197	ALA	4.3
1	A	211	LEU	4.3
1	A	220	VAL	4.3
1	A	81	THR	4.2
1	A	195	ILE	4.1
1	A	111	ASP	4.1
1	A	55	VAL	4.1

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Mol	Chain	Res	Type	RSRZ
1	A	119	THR	4.0
1	A	71	THR	3.9
1	A	165	LEU	3.9
1	A	199	SER	3.9
1	A	191	LEU	3.8
1	A	227	ASP	3.8
1	A	168	ASP	3.8
1	A	186	GLU	3.8
1	A	173	ILE	3.7
1	A	201	ILE	3.7
1	A	88	ALA	3.6
1	A	113	LEU	3.6
1	A	207	THR	3.6
1	A	164	ASP	3.6
1	A	90	VAL	3.5
1	A	194	GLU	3.5
1	A	188	ALA	3.5
1	A	172	LEU	3.4
1	A	190	LEU	3.4
1	A	106	GLY	3.4
1	A	200	TYR	3.4
1	A	110	PHE	3.4
1	A	98	ARG	3.4
1	A	174	GLU	3.4
1	A	60	VAL	3.3
1	A	59	ALA	3.3
1	A	225	TYR	3.3
1	A	147	ILE	3.3
1	A	182	PRO	3.2
1	A	97	VAL	3.2
1	A	94	GLY	3.1
1	A	117	CYS	3.1
1	A	114	ARG	3.1
1	A	198	ALA	3.1
1	A	87	SER	3.1
1	A	196	LYS	3.0
1	A	187	ALA	3.0
1	A	150	HIS	3.0
1	A	208	GLN	3.0
1	A	178	CYS	2.9
1	A	163[A]	SER	2.9
1	A	50	VAL	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	134	SER	2.9
1	A	112	LYS	2.8
1	A	179	LYS	2.8
1	A	205	ALA	2.8
1	A	130	VAL	2.8
1	A	203	CYS	2.7
1	A	149	CYS	2.7
1	A	84	ASP	2.7
1	A	96	PRO	2.6
1	A	170	LYS	2.6
1	A	143	TRP	2.6
1	A	206	LEU	2.6
1	A	153	LYS	2.6
1	A	126	LEU	2.6
1	A	184	PRO	2.6
1	A	101	LEU	2.5
1	A	159	VAL	2.5
1	A	68	SER	2.4
1	A	131	VAL	2.4
1	A	65	LEU	2.4
1	A	64	SER	2.4
1	A	92	VAL	2.4
1	A	58	GLY	2.3
1	A	210	ASN	2.3
1	A	204	SER	2.3
1	A	124	PHE	2.3
1	A	93	ASP	2.3
1	A	100	GLN	2.2
1	A	158	LEU	2.2
1	A	175	LEU	2.2
1	A	91	SER	2.2
1	A	53	VAL	2.2
1	A	167	GLU	2.2
1	A	120	ASN	2.2
1	A	154	ALA	2.2
1	A	161	THR	2.2
1	A	140	SER	2.2
1	A	86	PHE	2.2
1	A	213	GLU	2.1
1	A	133	PRO	2.1
1	A	123	ILE	2.1
1	A	67	VAL	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	63	THR	2.1
1	A	118	TYR	2.1
1	A	157	ILE	2.1
1	A	66[A]	VAL	2.0
1	A	152	PRO	2.0
1	A	95	ARG	2.0
1	A	108	ASP	2.0
1	A	183	VAL	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 oligosaccharides in this entry.

6.4 Ligands [i](#)

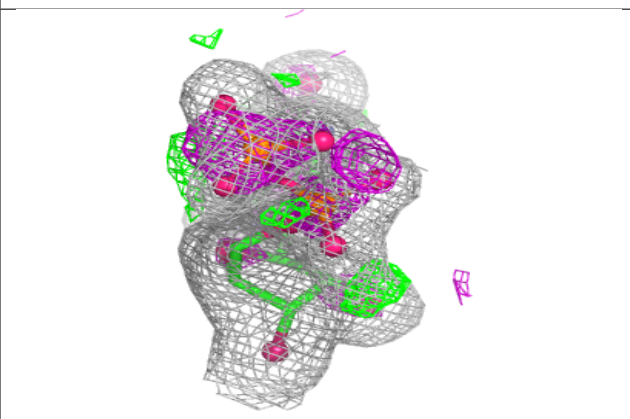
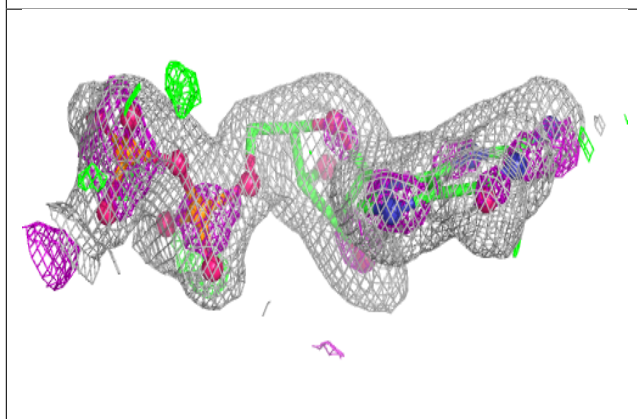
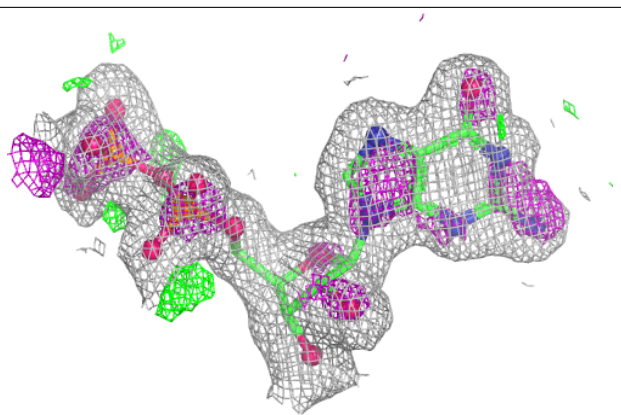
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	GDP	A	3444	28/28	0.95	0.11	27,33,39,42	0
2	MG	A	1	1/1	0.98	0.13	40,40,40,40	0

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 GDP A 3444:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



6.5 Other polymers [i](#)

There are no such residues in this entry.