



# Full wwPDB X-ray Structure Validation Report

Feb 28, 2014 – 11:31 AM GMT

PDB ID : 3OBJ  
Title : Conformational plasticity of p38 MAP kinase DFG mutants in response to inhibitor binding  
Authors : Namboodiri, H.V.; Karpusas, M.; Bukhtiyarova, M.; Springman, E.B.  
Deposited on : 2010-08-06  
Resolution : 2.40 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>

---

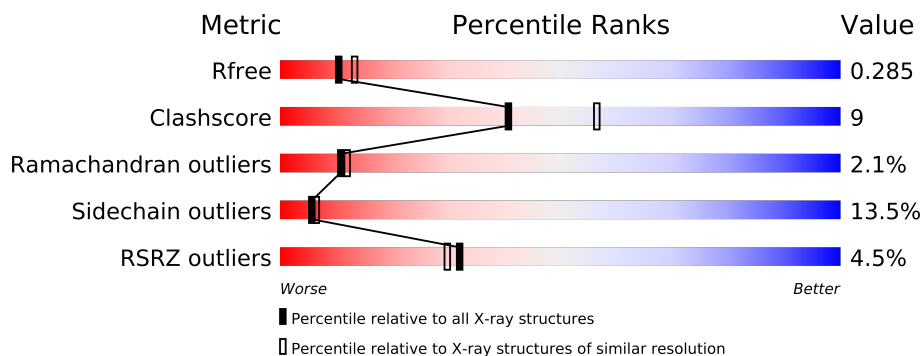
The following versions of software and data (see [references](#)) were used in the production of this report:

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 2.40 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))
$R_{free}$	66092	2207 (2.40-2.40)
Clashscore	79885	2789 (2.40-2.40)
Ramachandran outliers	78287	2736 (2.40-2.40)
Sidechain outliers	78261	2737 (2.40-2.40)
RSRZ outliers	66119	2210 (2.40-2.40)

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	360	

## 2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 2832 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.

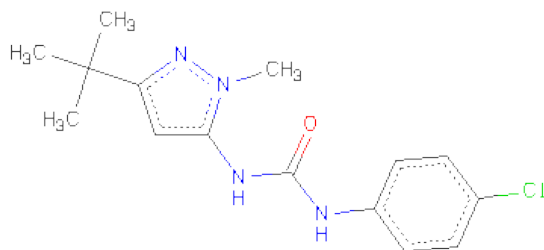
- Molecule 1 is a protein called Mitogen-activated protein kinase 14.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	332	2683	1721	462	488	12	0	0	0

There is a discrepancy between the modelled and reference sequences:

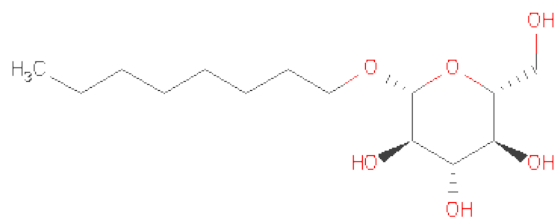
Chain	Residue	Modelled	Actual	Comment	Reference
A	169	ARG	PHE	ENGINEERED MUTATION	UNP Q16539

- Molecule 2 is 1-(5-TERT-BUTYL-2-METHYL-2H-PYRAZOL-3-YL)-3-(4-CHLORO-PHENYL)-UREA (three-letter code: BMU) (formula:  $C_{15}H_{19}ClN_4O$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Cl	N	O		
2	A	1	21	15	1	4	1	0	0

- Molecule 3 is SUGAR (B-OCTYLGLUCOSIDE) (three-letter code: BOG) (formula:  $C_{14}H_{28}O_6$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			20	14	6		

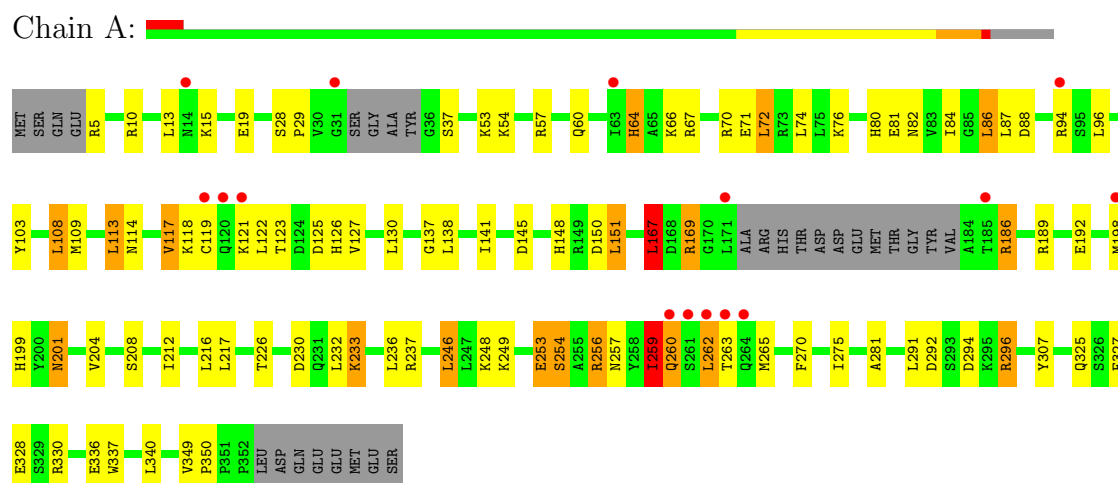
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	108	Total	O	0	0
			108	108		

### 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 ( $RSRZ > 2$ ). 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: Mitogen-activated protein kinase 14



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	68.32Å 69.84Å 76.09Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.41 – 2.40 33.41 – 2.40	Depositor EDS
% Data completeness (in resolution range)	99.8 (33.41-2.40) 99.9 (33.41-2.40)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.65 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.215 , 0.287 0.214 , 0.285	Depositor DCC
$R_{free}$ test set	1138 reflections (8.35%)	DCC
Wilson B-factor (Å <sup>2</sup> )	30.1	Xtriage
Anisotropy	0.537	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 22.3	EDS
Estimated twinning fraction	0.024 for k,h,-l	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 14765 reflections	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	2832	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.01% 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: BOG, BMU

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	0.71	0/2743	0.84	4/3721 (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

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	167	LEU	CA-CB-CG	6.67	130.64	115.30
1	A	108	LEU	CA-CB-CG	6.66	130.62	115.30
1	A	296	ARG	NE-CZ-NH2	-5.30	117.65	120.30
1	A	151	LEU	CA-CB-CG	5.05	126.91	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	169	ARG	Peptide

### 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	2683	0	2697	51	0
2	A	21	0	19	1	0
3	A	20	0	28	4	0
4	A	108	0	0	3	0
All	All	2832	0	2744	51	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 9.

All (51) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:254:SER:HA	1:A:257:ASN:HB2	1.38	1.05
1:A:233:LYS:HZ3	1:A:262:LEU:HD11	1.26	1.01
1:A:233:LYS:NZ	1:A:262:LEU:HD11	1.88	0.89
1:A:123:THR:HG22	1:A:125:ASP:H	1.45	0.81
1:A:113:LEU:O	1:A:117:VAL:HG23	1.83	0.78
1:A:233:LYS:HZ3	1:A:262:LEU:CD1	1.99	0.75
1:A:199:HIS:O	3:A:362:BOG:O6	2.02	0.75
1:A:148:HIS:HD2	1:A:150:ASP:H	1.33	0.75
1:A:57:ARG:O	1:A:64:HIS:HD2	1.76	0.68
1:A:113:LEU:HD11	1:A:216:LEU:HD21	1.79	0.65
1:A:70:ARG:O	1:A:74:LEU:HB2	1.98	0.64
1:A:233:LYS:HE3	1:A:237:ARG:HD2	1.81	0.62
1:A:80:HIS:CD2	1:A:82:ASN:H	2.20	0.59
1:A:80:HIS:HD2	1:A:82:ASN:H	1.53	0.57
1:A:208:SER:O	1:A:212:ILE:HG13	2.04	0.56
1:A:54:LYS:HB2	1:A:103:TYR:CE2	2.41	0.55
1:A:148:HIS:HE1	1:A:167:LEU:O	1.89	0.55
1:A:192:GLU:OE1	1:A:296:ARG:NH2	2.42	0.53
1:A:66:LYS:HE3	1:A:337:TRP:CZ2	2.44	0.52
1:A:84:ILE:HD12	1:A:167:LEU:HD23	1.91	0.52
1:A:72:LEU:HD22	1:A:76:LYS:HG3	1.92	0.51
1:A:336:GLU:O	1:A:340:LEU:HD13	2.11	0.50
1:A:54:LYS:HB2	1:A:103:TYR:CD2	2.48	0.48
1:A:253:GLU:HG3	1:A:254:SER:N	2.29	0.48
1:A:10:ARG:NH1	1:A:19:GLU:OE2	2.45	0.48
1:A:123:THR:HG22	1:A:125:ASP:N	2.23	0.47
1:A:201:ASN:O	1:A:204:VAL:HG13	2.15	0.47

*Continued on next page...*



Continued from previous page...

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:122:LEU:HA	1:A:126:HIS:HD2	1.80	0.46
1:A:226:THR:HG22	1:A:230:ASP:CB	2.44	0.46
1:A:246:LEU:HG	1:A:292:ASP:HB2	1.97	0.45
1:A:186:ARG:HA	1:A:189:ARG:HG3	2.00	0.44
1:A:256:ARG:NH2	4:A:431:HOH:O	2.50	0.44
1:A:291:LEU:O	3:A:362:BOG:H2'2	2.18	0.44
1:A:86:LEU:HD22	1:A:88:ASP:O	2.19	0.43
1:A:81:GLU:HG3	4:A:399:HOH:O	2.19	0.43
1:A:127:VAL:HG21	1:A:217:LEU:HD23	2.01	0.42
1:A:236:LEU:HD12	1:A:262:LEU:HD12	2.01	0.42
1:A:349:VAL:HA	1:A:350:PRO:HD3	1.88	0.42
1:A:294:ASP:OD1	3:A:362:BOG:O3	2.26	0.42
1:A:53:LYS:O	1:A:103:TYR:HA	2.19	0.42
1:A:66:LYS:NZ	1:A:328:GLU:O	2.51	0.42
1:A:67:ARG:HG3	4:A:427:HOH:O	2.19	0.42
1:A:71:GLU:OE1	2:A:361:BMU:H153	2.19	0.42
1:A:281:ALA:HB2	1:A:307:TYR:CE1	2.55	0.42
1:A:233:LYS:HD2	1:A:262:LEU:HD21	2.02	0.41
1:A:137:GLY:O	1:A:141:ILE:HG12	2.20	0.41
1:A:259:ILE:HG12	1:A:259:ILE:H	1.36	0.41
1:A:291:LEU:O	3:A:362:BOG:C2'	2.69	0.41
1:A:28:SER:HA	1:A:29:PRO:HD3	1.98	0.41
1:A:270:PHE:N	1:A:270:PHE:CD2	2.89	0.41
1:A:262:LEU:O	1:A:262:LEU:HD13	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	326/360 (91%)	302 (93%)	17 (5%)	7 (2%)	11 12

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	119	CYS
1	A	253	GLU
1	A	259	ILE
1	A	263	THR
1	A	327	PHE
1	A	117	VAL
1	A	260	GLN

### 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	296/320 (92%)	256 (86%)	40 (14%)	<b>6</b> <b>6</b>

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	5	ARG
1	A	13	LEU
1	A	15	LYS
1	A	37	SER
1	A	60	GLN
1	A	64	HIS
1	A	72	LEU
1	A	86	LEU
1	A	87	LEU
1	A	94	ARG
1	A	96	LEU
1	A	108	LEU
1	A	109	MET
1	A	113	LEU
1	A	114	ASN
1	A	118	LYS
1	A	121	LYS
1	A	130	LEU
1	A	138	LEU
1	A	145	ASP
1	A	151	LEU

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	A	167	LEU
1	A	169	ARG
1	A	186	ARG
1	A	198	MET
1	A	201	ASN
1	A	232	LEU
1	A	233	LYS
1	A	246	LEU
1	A	248	LYS
1	A	249	LYS
1	A	254	SER
1	A	256	ARG
1	A	259	ILE
1	A	260	GLN
1	A	262	LEU
1	A	265	MET
1	A	275	ILE
1	A	325	GLN
1	A	330	ARG

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	11	GLN
1	A	60	GLN
1	A	64	HIS
1	A	80	HIS
1	A	114	ASN
1	A	126	HIS
1	A	148	HIS
1	A	264	GLN
1	A	269	ASN

### 5.3.3 RNA ⓘ

There are no RNA chains in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

2 ligands 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	$\# Z  > 2$
2	BMU	A	361	-	22,22,22	1.63	7 (31%)	32,32,32	5.34	9 (28%)
3	BOG	A	362	-	20,20,20	0.37	0	25,25,25	1.66	4 (16%)

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
2	BMU	A	361	-	-	0/12/14/14	0/2/2/2
3	BOG	A	362	-	-	0/11/31/31	0/1/1/1

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	361	BMU	C3-N2	-3.61	1.34	1.41
2	A	361	BMU	N12-N11	2.28	1.40	1.37
2	A	361	BMU	C6-CL6	2.26	1.79	1.74
2	A	361	BMU	C1-N2	-2.25	1.33	1.37
2	A	361	BMU	C1-N9	-2.23	1.33	1.37
2	A	361	BMU	C15-N11	2.18	1.49	1.46
2	A	361	BMU	C10-N9	-2.07	1.35	1.39

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	361	BMU	C14-C10-N11	27.59	110.89	106.68
2	A	361	BMU	N9-C10-N11	-6.18	114.67	120.99
3	A	362	BOG	C4-C3-C2	-5.25	101.12	110.82
2	A	361	BMU	C15-N11-C10	5.13	136.56	128.81
2	A	361	BMU	C15-N11-N12	-4.83	115.45	120.78
2	A	361	BMU	C10-N11-N12	-3.89	107.98	112.06
3	A	362	BOG	C1-O5-C5	3.67	120.86	113.73
2	A	361	BMU	C14-C13-C16	-3.25	124.95	128.94
2	A	361	BMU	C10-C14-C13	-2.85	103.22	106.68
3	A	362	BOG	O5-C1-C2	2.24	114.90	110.31
2	A	361	BMU	C16-C13-N12	2.10	122.85	120.64
2	A	361	BMU	C3-N2-C1	2.09	130.76	126.66
3	A	362	BOG	C1'-O1-C1	-2.08	110.22	113.96

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	332/360 (92%)	0.01	15 (4%) 32 30	14, 29, 59, 75	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	119	CYS	5.5
1	A	263	THR	5.3
1	A	262	LEU	4.9
1	A	260	GLN	4.1
1	A	120	GLN	3.8
1	A	264	GLN	3.4
1	A	261	SER	3.3
1	A	121	LYS	3.3
1	A	171	LEU	3.0
1	A	14	ASN	2.9
1	A	185	THR	2.4
1	A	198	MET	2.4
1	A	63	ILE	2.2
1	A	94	ARG	2.1
1	A	31	GLY	2.1

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

There are no non-standard protein/DNA/RNA residues in this entry.

### 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( $\text{\AA}^2$ )	Q<0.9
3	BOG	A	362	20/20	0.17	0.66	39,45,55,57	0
2	BMU	A	361	21/21	0.09	-1.38	17,21,23,26	0

## 6.5 Other polymers

There are no such residues in this entry.