wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 04:19 AM GMT

PDB ID	:	2MEV
Title	:	STRUCTURAL REFINEMENT AND ANALYSIS OF MENGO VIRUS
Authors	:	Rossmann, M.G.
Deposited on	:	1989-04-21
Resolution	:	3.00 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

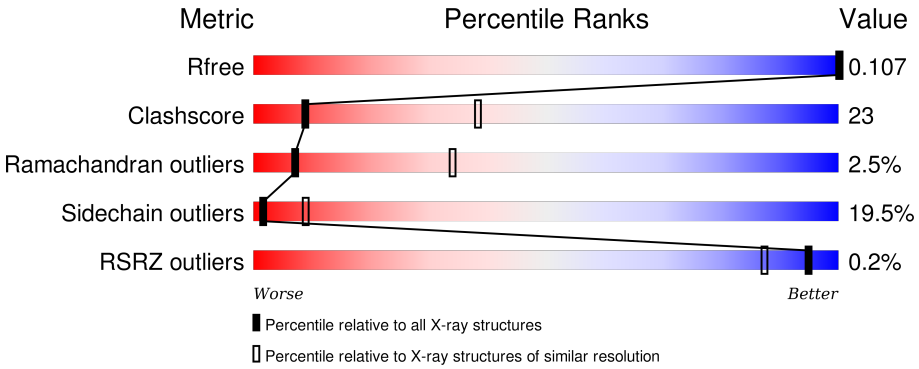
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

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 3.00 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}	91344	1578 (3.00-3.00)
Clashscore	102246	1912 (3.00-3.00)
Ramachandran outliers	100387	1853 (3.00-3.00)
Sidechain outliers	100360	1856 (3.00-3.00)
RSRZ outliers	91569	1592 (3.00-3.00)

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 >=3, 2, 1 and 0 types of geometric quality criteria. 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	1	277	45% 32% 14% 6% ·
2	2	256	55% 24% 11% 7% ·
3	3	231	55% 29% 12% ·
4	4	70	% 27% 30% 17% 9% 17%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6507 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 MENGO VIRUS COAT PROTEIN (SUBUNIT VP1).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	1	268	Total	C	N	O	S	0	0	0
			2091	1345	342	397	7			

- Molecule 2 is a protein called MENGO VIRUS COAT PROTEIN (SUBUNIT VP2).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	2	249	Total	C	N	O	S	0	0	0
			1973	1247	349	372	5			

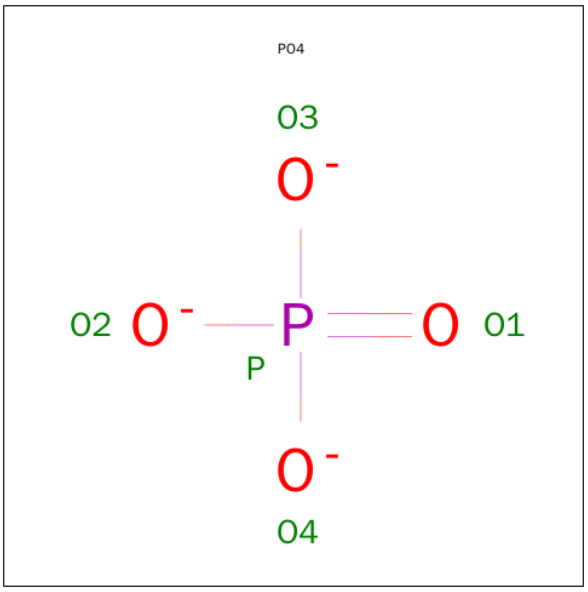
- Molecule 3 is a protein called MENGO VIRUS COAT PROTEIN (SUBUNIT VP3).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	3	231	Total	C	N	O	S	0	0	0
			1772	1153	283	326	10			

- Molecule 4 is a protein called MENGO VIRUS COAT PROTEIN (SUBUNIT VP4).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	4	58	Total	C	N	O	S	0	0	0
			433	270	71	91	1			

- Molecule 5 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	2	1	Total O P 5 4 1	0	0

- Molecule 6 is water.

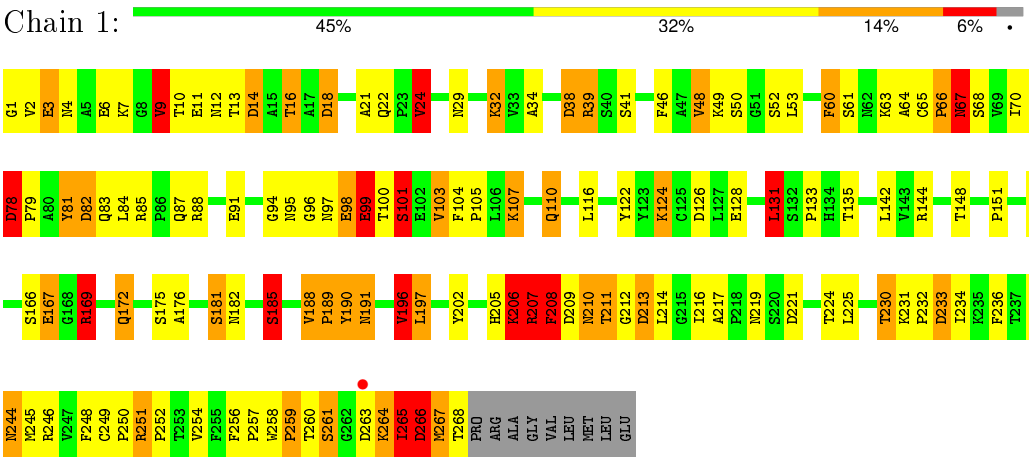
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	1	106	Total O 106 106	0	0
6	2	69	Total O 69 69	0	0
6	3	49	Total O 49 49	0	0
6	4	9	Total O 9 9	0	0

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.

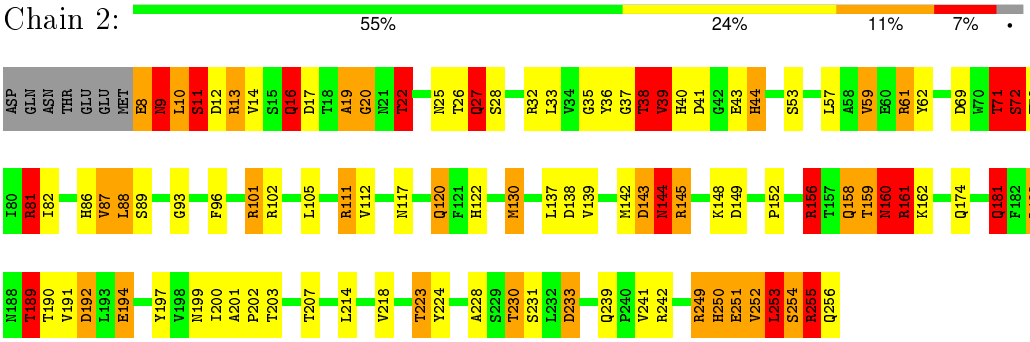
- Molecule 1: MENGO VIRUS COAT PROTEIN (SUBUNIT VP1)

Chain 1:



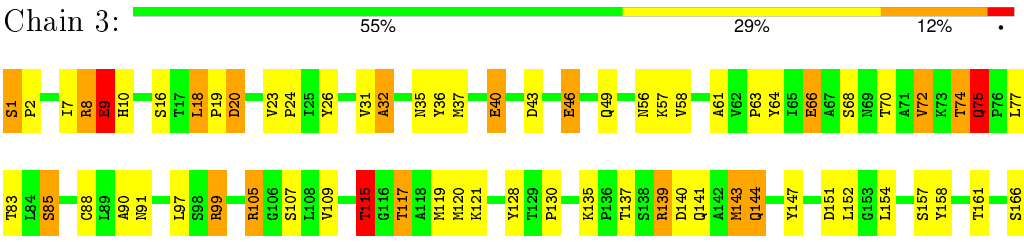
- Molecule 2: MENGO VIRUS COAT PROTEIN (SUBUNIT VP2)

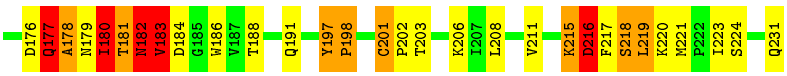
Chain 2:



- Molecule 3: MENGO VIRUS COAT PROTEIN (SUBUNIT VP3)

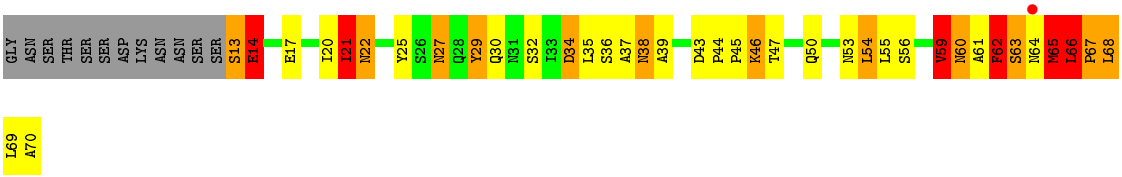
Chain 3:





• Molecule 4: MENGO VIRUS COAT PROTEIN (SUBUNIT VP4)

Chain 4:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	441.42Å 427.31Å 421.92Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 3.00 49.94 – 2.60	Depositor EDS
% Data completeness (in resolution range)	(Not available) (10.00-3.00) 41.3 (49.94-2.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.99 (at 2.61Å)	Xtriage
Refinement program	PROLSQ	Depositor
R, R_{free}	0.221 , (Not available) 0.200 , 0.107	Depositor DCC
R_{free} test set	873 reflections (0.10%)	DCC
Wilson B-factor (Å^2)	16.8	Xtriage
Anisotropy	0.307	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 174.2	EDS
Estimated twinning fraction	0.055 for k,h,-l 0.050 for -l,-k,-h 0.049 for -h,l,k 0.049 for l,h,k 0.049 for k,l,h	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.40$, $< L^2 > = 0.22$	Xtriage
Outliers	1 of 991793 reflections (0.000%)	Xtriage
F_o,F_c correlation	0.09	EDS
Total number of atoms	6507	wwPDB-VP
Average B, all atoms (Å^2)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.92% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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: PO4

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	1	1.14	2/2159 (0.1%)	2.35	115/2952 (3.9%)
2	2	1.13	6/2028 (0.3%)	2.60	122/2776 (4.4%)
3	3	1.07	3/1829 (0.2%)	2.13	73/2512 (2.9%)
4	4	1.34	1/441 (0.2%)	2.99	52/600 (8.7%)
All	All	1.14	12/6457 (0.2%)	2.42	362/8840 (4.1%)

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
2	2	0	2

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	2	20	GLY	N-CA	8.56	1.58	1.46
2	2	11	SER	CB-OG	7.89	1.52	1.42
2	2	254	SER	CB-OG	6.83	1.51	1.42
1	1	211	THR	CB-OG1	6.46	1.56	1.43
2	2	43	GLU	CD-OE2	6.13	1.32	1.25

The worst 5 of 362 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	2	102	ARG	NE-CZ-NH2	-21.77	109.42	120.30
2	2	61	ARG	NE-CZ-NH1	20.67	130.63	120.30
1	1	267	MET	C-N-CA	20.41	172.73	121.70
3	3	216	ASP	CB-CG-OD2	-19.35	100.88	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	2	161	ARG	CD-NE-CZ	18.62	149.67	123.60

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	2	255	ARG	Sidechain
2	2	81	ARG	Sidechain

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	1	2091	0	2008	104	0
2	2	1973	0	1899	98	0
3	3	1772	0	1760	88	0
4	4	433	0	404	28	0
5	2	5	0	0	0	0
6	1	106	0	0	0	0
6	2	69	0	0	3	0
6	3	49	0	0	0	0
6	4	9	0	0	0	0
All	All	6507	0	6071	289	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 23.

The worst 5 of 289 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)
2:2:10:LEU:O	2:2:13:ARG:HB2	1.38	1.22
3:3:179:ASN:HB3	3:3:183:VAL:HG13	1.39	1.04
2:2:101:ARG:HD3	2:2:255:ARG:HB2	1.36	1.04
1:1:14:ASP:OD2	1:1:16:THR:HB	1.58	1.03
1:1:32:LYS:HE2	4:4:13:SER:HB2	1.41	1.02

There are no symmetry-related clashes.

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	Percentiles
1	1	266/277 (96%)	238 (90%)	20 (8%)	8 (3%)	5 29
2	2	247/256 (96%)	227 (92%)	17 (7%)	3 (1%)	16 56
3	3	229/231 (99%)	208 (91%)	16 (7%)	5 (2%)	8 38
4	4	56/70 (80%)	46 (82%)	6 (11%)	4 (7%)	1 7
All	All	798/834 (96%)	719 (90%)	59 (7%)	20 (2%)	7 34

5 of 20 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	1	77	PHE
1	1	99	GLU
1	1	266	ASP
2	2	11	SER
2	2	253	LEU

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	1	233/240 (97%)	187 (80%)	46 (20%)	1 9
2	2	217/224 (97%)	177 (82%)	40 (18%)	2 10
3	3	195/195 (100%)	162 (83%)	33 (17%)	2 13

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
4	4	48/59 (81%)	32 (67%)	16 (33%)	0 1
All	All	693/718 (96%)	558 (80%)	135 (20%)	2 9

5 of 135 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	2	117	ASN
2	2	189	THR
4	4	27	ASN
2	2	120	GLN
2	2	158	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 28 such sidechains are listed below:

Mol	Chain	Res	Type
2	2	158	GLN
2	2	184	ASN
4	4	50	GLN
2	2	160	ASN
2	2	181	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry (i)

1 ligand is 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	$\#\|Z\| > 2$
5	PO4	2	257	-	4,4,4	2.07	3 (75%)	6,6,6	0.26	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
5	PO4	2	257	-	-	0/0/0/0	0/0/0/0

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	2	257	PO4	P-O4	-2.21	1.45	1.53
5	2	257	PO4	P-O3	-2.21	1.45	1.53
5	2	257	PO4	P-O2	-2.21	1.45	1.53

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 (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, 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	<RSRZ>	#RSRZ>2	OWAB(Å^2)	Q<0.9
1	1	268/277 (96%)	-0.65	1 (0%) 93 80	2, 9, 57, 77	0
2	2	249/256 (97%)	-0.84	0 100 100	2, 7, 44, 62	0
3	3	231/231 (100%)	-0.75	0 100 100	2, 7, 40, 82	0
4	4	58/70 (82%)	0.28	1 (1%) 73 45	13, 38, 60, 61	0
All	All	806/834 (96%)	-0.67	2 (0%) 95 87	2, 8, 52, 82	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	4	64	ASN	2.7
1	1	263	ASP	2.2

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^{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	LLDF	B-factors(Å^2)	Q<0.9
5	PO4	2	257	5/5	0.98	0.13	0.50	43,56,64,66	0

6.5 Other polymers (i)

There are no such residues in this entry.