Full wwPDB X-ray Structure Validation Report

Dec 21, 2016 – 01:07 PM EST

PDB ID	:	2V89
Title	:	Crystal structure of RAG2-PHD finger in complex with H3K4me3 peptide at 1.1A resolution
Authors	:	Ramon-Maiques, S.; Yang, W.
Deposited on	:	2007-08-03
Resolution	:	1.10 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
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:

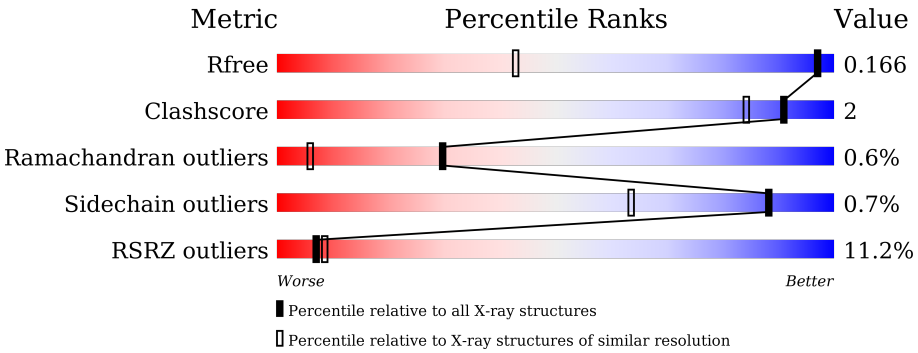
MolProbity	:	4.02b-467
Mogul	:	1.7.1 (RC1), CSD as537be (2016)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20028442
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20028442

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 1.10 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	1006 (1.14-1.06)
Clashscore	102246	1055 (1.14-1.06)
Ramachandran outliers	100387	1016 (1.14-1.06)
Sidechain outliers	100360	1014 (1.14-1.06)
RSRZ outliers	91569	1009 (1.14-1.06)

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	A	82	10%, 83%, 10%, • 5%
1	B	82	6%, 80%, 9%, • 10%
2	D	10	30%, 90%, 10%
2	E	10	30%, 80%, 20%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3042 atoms, of which 1314 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 VDJ RECOMBINATION-ACTIVATING PROTEIN 2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	78	Total	C	H	N	O	S	0	6	0
			1256	419	597	110	122	8			
1	B	74	Total	C	H	N	O	S	0	0	1
			1133	374	539	101	111	8			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1406	GLY	-	EXPRESSION TAG	UNP P21784
A	1407	PRO	-	EXPRESSION TAG	UNP P21784
A	1408	LEU	-	EXPRESSION TAG	UNP P21784
A	1409	GLY	-	EXPRESSION TAG	UNP P21784
A	1410	SER	-	EXPRESSION TAG	UNP P21784
A	1411	PRO	-	EXPRESSION TAG	UNP P21784
A	1412	GLU	-	EXPRESSION TAG	UNP P21784
A	1413	PHE	-	EXPRESSION TAG	UNP P21784
B	406	GLY	-	EXPRESSION TAG	UNP P21784
B	407	PRO	-	EXPRESSION TAG	UNP P21784
B	408	LEU	-	EXPRESSION TAG	UNP P21784
B	409	GLY	-	EXPRESSION TAG	UNP P21784
B	410	SER	-	EXPRESSION TAG	UNP P21784
B	411	PRO	-	EXPRESSION TAG	UNP P21784
B	412	GLU	-	EXPRESSION TAG	UNP P21784
B	413	PHE	-	EXPRESSION TAG	UNP P21784

- Molecule 2 is a protein called HISTONE H3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	10	Total	C	H	N	O	0	0	0
			165	46	89	16	14			
2	E	10	Total	C	H	N	O	0	1	0
			165	46	89	16	14			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	3008	ALA	ARG	CONFLICT	UNP Q5TEC6
D	3010	ALA	SER	CONFLICT	UNP Q5TEC6
E	2008	ALA	ARG	CONFLICT	UNP Q5TEC6
E	2010	ALA	SER	CONFLICT	UNP Q5TEC6

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

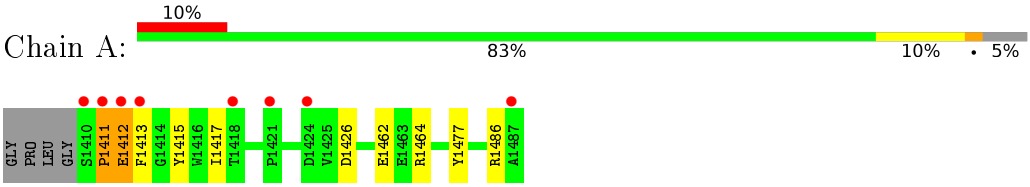
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	140	Total O 140 140	0	0
4	B	136	Total O 136 136	0	0
4	D	22	Total O 22 22	0	0
4	E	21	Total O 21 21	0	0

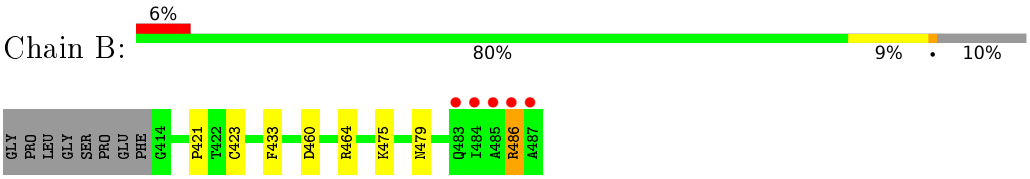
3 Residue-property plots (i)

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.

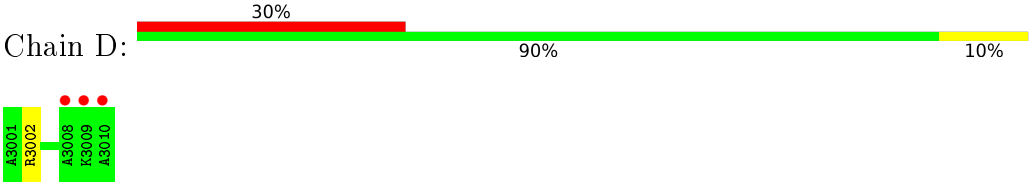
- Molecule 1: VDJ RECOMBINATION-ACTIVATING PROTEIN 2



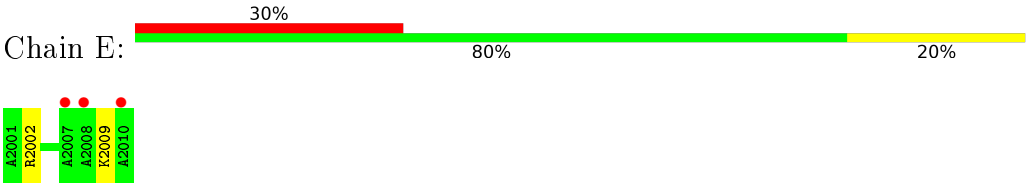
- Molecule 1: VDJ RECOMBINATION-ACTIVATING PROTEIN 2



- Molecule 2: HISTONE H3



- Molecule 2: HISTONE H3



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	75.98Å 46.81Å 56.81Å 90.00° 106.78° 90.00°	Depositor
Resolution (Å)	50.00 – 1.10 35.31 – 1.00	Depositor EDS
% Data completeness (in resolution range)	93.8 (50.00-1.10) 73.5 (35.31-1.00)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.94 (at 1.00Å)	Xtriage
Refinement program	SHELXL-97	Depositor
R, R_{free}	0.123 , 0.155 0.151 , 0.166	Depositor DCC
R_{free} test set	3000 reflections (4.32%)	DCC
Wilson B-factor (Å^2)	9.7	Xtriage
Anisotropy	0.288	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 75.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	3042	wwPDB-VP
Average B, all atoms (Å^2)	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.67% 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, 0.333 respectively for untwinned datasets, and 0.375, 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: ZN, M3L

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	0.76	0/691	1.34	6/943 (0.6%)
1	B	0.86	0/613	1.41	7/837 (0.8%)
2	D	0.75	0/63	1.71	2/82 (2.4%)
2	E	0.88	0/74	1.72	2/96 (2.1%)
All	All	0.81	0/1441	1.41	17/1958 (0.9%)

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 (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	1486	ARG	NE-CZ-NH2	-10.50	115.05	120.30
1	B	486	ARG	NE-CZ-NH2	10.37	125.48	120.30
1	B	464	ARG	NE-CZ-NH1	8.86	124.73	120.30
2	D	3002	ARG	NE-CZ-NH2	-7.33	116.63	120.30
1	A	1415	TYR	CB-CG-CD2	-7.10	116.74	121.00
1	A	1464	ARG	NE-CZ-NH2	-7.09	116.76	120.30
1	B	460	ASP	CB-CG-OD1	6.86	124.47	118.30
1	A	1462	GLU	OE1-CD-OE2	6.48	131.07	123.30
1	B	475	LYS	CB-CG-CD	6.39	128.21	111.60
2	D	3002	ARG	NE-CZ-NH1	5.94	123.27	120.30
1	B	460	ASP	CB-CG-OD2	-5.90	112.99	118.30
1	A	1477	TYR	CB-CG-CD2	-5.89	117.47	121.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	479	ASN	OD1-CG-ND2	-5.66	108.89	121.90
1	A	1426	ASP	CB-CG-OD2	5.48	123.23	118.30
2	E	2002[A]	ARG	NE-CZ-NH1	5.29	122.95	120.30
2	E	2002[B]	ARG	NE-CZ-NH1	5.29	122.95	120.30
1	B	479	ASN	CB-CG-ND2	5.04	128.80	116.70

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	1411[B]	PRO	Peptide

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	659	597	575	4	0
1	B	594	539	537	3	0
2	D	76	89	85	0	0
2	E	76	89	72	2	0
3	A	2	0	0	0	0
3	B	2	0	0	0	0
4	A	140	0	0	2	0
4	B	136	0	0	0	0
4	D	22	0	0	0	0
4	E	21	0	0	0	0
All	All	1728	1314	1269	6	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 2.

All (6) 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:1413[B]:PHE:O	1:A:1417:ILE:HG23	1.91	0.70

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1412[B]:GLU:HA	4:A:2033:HOH:O	1.95	0.65
1:A:1411[B]:PRO:HA	1:B:433:PHE:CZ	2.34	0.62
1:B:421:PRO:O	2:E:2009:LYS:HB2	2.09	0.52
1:B:423:CYS:N	2:E:2009:LYS:HE3	2.29	0.47
1:A:1413[B]:PHE:N	4:A:2033:HOH:O	2.50	0.45

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	A	81/82 (99%)	75 (93%)	4 (5%)	2 (2%)	7 0
1	B	72/82 (88%)	68 (94%)	4 (6%)	0	100 100
2	D	7/10 (70%)	7 (100%)	0	0	100 100
2	E	8/10 (80%)	8 (100%)	0	0	100 100
All	All	168/184 (91%)	158 (94%)	8 (5%)	2 (1%)	30 1

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1412[A]	GLU
1	A	1412[B]	GLU

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	71/72 (99%)	71 (100%)	0	100	100
1	B	66/72 (92%)	65 (98%)	1 (2%)	72	33
2	D	5/5 (100%)	5 (100%)	0	100	100
2	E	6/5 (120%)	6 (100%)	0	100	100
All	All	148/154 (96%)	147 (99%)	1 (1%)	88	63

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

Mol	Chain	Res	Type
1	B	486	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1479	ASN
1	B	474	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

2 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	$\#\|Z\| > 2$
2	M3L	D	3004	2	9,11,12	0.95	0	12,14,16	1.34	2 (16%)
2	M3L	E	2004	2	9,11,12	1.14	0	12,14,16	1.14	1 (8%)

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	M3L	D	3004	2	-	0/8/10/12	0/0/0/0
2	M3L	E	2004	2	-	0/8/10/12	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(^{o})	Ideal(^{o})
2	D	3004	M3L	CM2-NZ-CM1	-3.01	101.17	108.96
2	E	2004	M3L	CM2-NZ-CE	-2.30	100.59	109.92
2	D	3004	M3L	CM3-NZ-CM1	2.72	116.00	108.96

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

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	A	78/82 (95%)	0.52	8 (10%) 9 10	9, 13, 28, 45	7 (8%)
1	B	74/82 (90%)	0.18	5 (6%) 20 19	7, 11, 26, 46	4 (5%)
2	D	9/10 (90%)	1.19	3 (33%) 0 2	8, 11, 21, 23	3 (33%)
2	E	9/10 (90%)	1.55	3 (33%) 0 2	11, 14, 31, 37	4 (44%)
All	All	170/184 (92%)	0.46	19 (11%) 7 8	7, 13, 29, 46	18 (10%)

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1487	ALA	6.6
2	E	2010	ALA	6.1
1	B	487	ALA	5.3
2	D	3008	ALA	5.0
1	A	1413[A]	PHE	4.6
2	E	2007	ALA	4.1
2	D	3010	ALA	4.0
1	B	486	ARG	3.9
2	E	2008	ALA	3.6
1	A	1424	ASP	3.5
1	A	1410[A]	SER	3.0
2	D	3009	LYS	2.9
1	A	1412[A]	GLU	2.6
1	A	1418	THR	2.6
1	A	1421	PRO	2.6
1	B	485	ALA	2.6
1	B	484	ILE	2.3
1	A	1411[A]	PRO	2.2
1	B	483	GLN	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (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. 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
2	M3L	D	3004	12/13	0.97	0.07	-	7,13,46,46	0
2	M3L	E	2004	12/13	0.95	0.09	-	9,24,47,47	0

6.3 Carbohydrates (i)

There are no carbohydrates 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. 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
3	ZN	A	2488	1/1	0.99	0.02	-1.40	10,10,10,10	0
3	ZN	B	1489	1/1	1.00	0.03	-1.49	8,8,8,8	0
3	ZN	A	2489	1/1	1.00	0.03	-1.95	9,9,9,9	0
3	ZN	B	1488	1/1	1.00	0.02	-4.19	7,7,7,7	0

6.5 Other polymers (i)

There are no such residues in this entry.