



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2024 – 02:07 PM EST

PDB ID : 3VR0
Title : Crystal structure of Pyrococcus furiosus PbaB, an archaeal proteasome activator
Authors : Kumoi, K.; Satoh, T.; Hiromoto, T.; Mizushima, T.; Kamiya, Y.; Noda, M.; Uchiyama, S.; Murata, K.; Yagi, H.; Kato, K.
Deposited on : 2012-04-02
Resolution : 2.20 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 : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.36
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

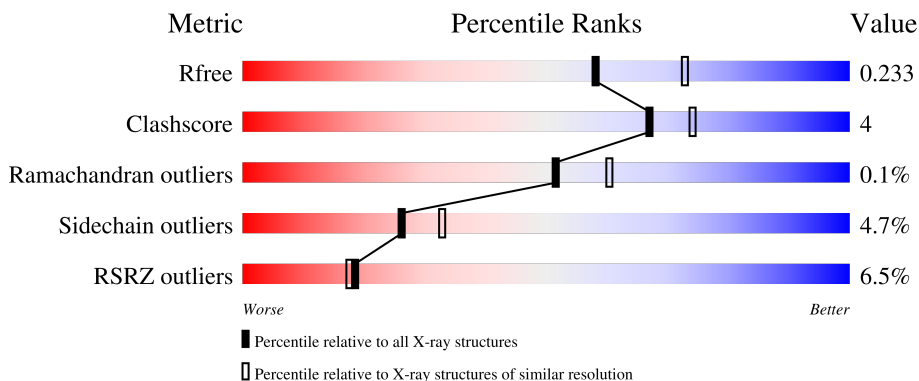
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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}	130704	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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	283	
1	B	283	
1	C	283	
1	D	283	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 8076 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 Putative uncharacterized protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	244	1915	1233	310	364	8	0	0	0
1	B	244	1915	1233	310	364	8	0	0	0
1	C	248	1948	1252	318	369	9	0	0	0
1	D	248	1945	1251	316	369	9	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP Q8U1R3
A	-1	SER	-	expression tag	UNP Q8U1R3
A	0	HIS	-	expression tag	UNP Q8U1R3
B	-2	GLY	-	expression tag	UNP Q8U1R3
B	-1	SER	-	expression tag	UNP Q8U1R3
B	0	HIS	-	expression tag	UNP Q8U1R3
C	-2	GLY	-	expression tag	UNP Q8U1R3
C	-1	SER	-	expression tag	UNP Q8U1R3
C	0	HIS	-	expression tag	UNP Q8U1R3
D	-2	GLY	-	expression tag	UNP Q8U1R3
D	-1	SER	-	expression tag	UNP Q8U1R3
D	0	HIS	-	expression tag	UNP Q8U1R3

- Molecule 2 is GOLD ION (three-letter code: AU) (formula: Au).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	4	Total	Au	0	0
			4	4		
2	B	5	Total	Au	0	0
			5	5		

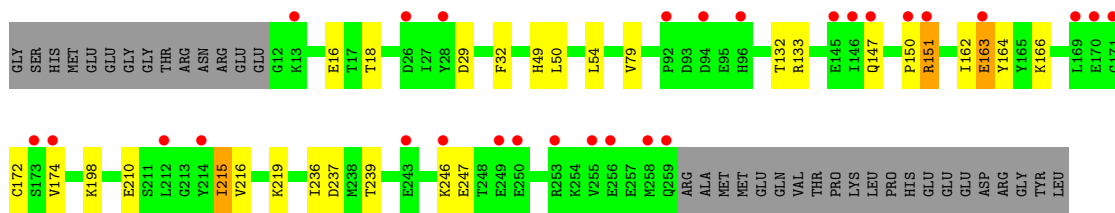
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	C	4	Total 4	Au 4	0	0
2	D	5	Total 5	Au 5	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	120	Total 120	O 120	0	0
3	B	70	Total 70	O 70	0	0
3	C	87	Total 87	O 87	0	0
3	D	58	Total 58	O 58	0	0



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	115.60Å 156.40Å 153.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.20 46.48 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.1 (20.00-2.20) 99.2 (46.48-2.20)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	7.80 (at 2.20Å)	Xtrriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.196 , 0.237 0.192 , 0.233	Depositor DCC
R_{free} test set	3507 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	34.5	Xtrriage
Anisotropy	0.058	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 49.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8076	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.38% 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

5.1 Standard geometry

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

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	0/1951	0.79	3/2635 (0.1%)
1	B	0.84	0/1951	0.78	2/2635 (0.1%)
1	C	0.89	0/1984	0.83	3/2678 (0.1%)
1	D	0.73	0/1981	0.72	0/2673
All	All	0.83	0/7867	0.78	8/10621 (0.1%)

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	24	ARG	NE-CZ-NH2	-6.59	117.00	120.30
1	B	102	VAL	CB-CA-C	-6.13	99.75	111.40
1	C	127	VAL	CG1-CB-CG2	5.66	119.96	110.90
1	A	29	ASP	CB-CG-OD1	5.43	123.19	118.30
1	C	71	VAL	CG1-CB-CG2	5.27	119.34	110.90
1	A	29	ASP	CB-CG-OD2	-5.23	113.59	118.30
1	A	125	ASP	CB-CG-OD2	-5.10	113.71	118.30
1	B	125	ASP	CB-CG-OD1	5.04	122.84	118.30

There are no chirality outliers.

There are no planarity outliers.

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	1915	0	1934	9	0
1	B	1915	0	1933	21	0
1	C	1948	0	1969	16	0
1	D	1945	0	1966	15	0
2	A	4	0	0	0	0
2	B	5	0	0	0	0
2	C	4	0	0	0	0
2	D	5	0	0	0	0
3	A	120	0	0	0	0
3	B	70	0	0	1	0
3	C	87	0	0	0	0
3	D	58	0	0	1	0
All	All	8076	0	7802	59	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 4.

All (59) 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:B:32:PHE:HE1	1:B:102:VAL:HG22	1.25	1.01
1:B:151:ARG:HD2	1:B:177:ILE:HD11	1.41	1.00
1:B:32:PHE:CE1	1:B:102:VAL:HG22	1.98	0.99
1:D:49:HIS:ND1	3:D:444:HOH:O	2.15	0.80
1:C:68:MET:HB3	1:C:82:MET:HE1	1.70	0.73
1:D:151:ARG:HG2	1:D:210:GLU:OE1	1.90	0.71
1:C:142:GLN:NE2	1:C:212:LEU:O	2.23	0.69
1:D:162:ILE:O	1:D:166:LYS:HB2	1.94	0.67
1:C:68:MET:HB3	1:C:82:MET:CE	2.29	0.63
1:B:45:LEU:HD11	1:B:216:VAL:HG12	1.82	0.61
1:B:32:PHE:CE1	1:B:102:VAL:CG2	2.79	0.60
1:A:244:ARG:O	1:A:248:THR:HG23	2.05	0.57
1:C:71:VAL:CG1	1:C:79:VAL:HB	2.34	0.57
1:D:50:LEU:O	1:D:54:LEU:HB2	2.08	0.53
1:D:163:GLU:HG2	1:D:164:TYR:N	2.24	0.53
1:D:172:CYS:SG	1:D:174:VAL:HG12	2.48	0.52
1:C:172:CYS:SG	1:C:174:VAL:HG22	2.50	0.52
1:A:218:ALA:HB2	1:A:244:ARG:HD3	1.91	0.52
1:B:172:CYS:SG	1:B:174:VAL:HG12	2.50	0.52
1:C:47:ALA:O	1:C:51:ILE:HG12	2.11	0.51
1:B:215:ILE:H	1:B:215:ILE:HD13	1.75	0.51
1:C:71:VAL:HG11	1:C:79:VAL:HB	1.93	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:168:LYS:O	1:C:230:LYS:HD2	2.12	0.49
1:C:32:PHE:HB2	1:C:132:THR:HG21	1.94	0.49
1:D:16:GLU:O	1:D:18:THR:HG23	2.12	0.49
1:D:32:PHE:HB2	1:D:132:THR:HG21	1.94	0.49
1:A:41:LEU:HD12	1:A:216:VAL:HG22	1.95	0.48
1:C:41:LEU:HD12	1:C:216:VAL:HG22	1.95	0.48
1:B:34:GLU:OE2	3:B:420:HOH:O	2.20	0.48
1:B:17:THR:HB	1:B:122:LYS:HG3	1.94	0.47
1:B:49:HIS:HE1	1:B:240:ALA:HB3	1.78	0.47
1:C:71:VAL:HG13	1:C:79:VAL:HB	1.96	0.47
1:D:29:ASP:OD1	1:D:133:ARG:NH1	2.47	0.47
1:A:215:ILE:HG13	1:A:216:VAL:N	2.29	0.47
1:C:45:LEU:HD13	1:C:218:ALA:HA	1.98	0.46
1:C:163:GLU:HA	1:C:166:LYS:HB2	1.98	0.46
1:D:237:ASP:OD1	1:D:239:THR:HG23	2.17	0.45
1:B:135:ILE:O	1:B:204:GLY:HA3	2.18	0.44
1:D:151:ARG:HG2	1:D:210:GLU:CD	2.36	0.44
1:C:172:CYS:HB2	1:C:230:LYS:HG2	1.99	0.44
1:A:162:ILE:HG22	1:A:166:LYS:HD3	2.00	0.44
1:B:138:MET:HB3	1:B:224:VAL:HG11	1.98	0.44
1:B:93:ASP:HB3	1:B:95:GLU:H	1.82	0.44
1:D:236:ILE:HD13	1:D:236:ILE:HA	1.90	0.43
1:B:146:ILE:O	1:B:146:ILE:HG13	2.18	0.43
1:D:215:ILE:HD13	1:D:215:ILE:HA	1.86	0.43
1:A:198:LYS:NZ	1:D:79:VAL:O	2.50	0.43
1:B:78:VAL:HA	1:C:156:VAL:O	2.19	0.43
1:A:32:PHE:HB2	1:A:132:THR:HG21	2.02	0.42
1:B:138:MET:SD	1:B:228:VAL:HG21	2.60	0.42
1:B:30:PRO:HA	1:B:98:ASP:O	2.20	0.42
1:B:108:VAL:HA	1:B:109:PRO:HD3	1.96	0.42
1:D:150:PRO:HD3	1:D:219:LYS:HE3	2.02	0.41
1:A:251:ILE:O	1:A:255:VAL:HG23	2.20	0.41
1:B:146:ILE:HD12	1:B:148:GLY:O	2.21	0.41
1:B:243:GLU:HA	1:B:246:LYS:HB3	2.01	0.41
1:A:246:LYS:HD3	1:A:246:LYS:HA	1.73	0.40
1:B:174:VAL:HG21	1:B:223:ALA:HB1	2.02	0.40
1:C:127:VAL:HG13	1:C:132:THR:HB	2.03	0.40

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	242/283 (86%)	235 (97%)	7 (3%)	0	100	100
1	B	242/283 (86%)	232 (96%)	10 (4%)	0	100	100
1	C	246/283 (87%)	235 (96%)	11 (4%)	0	100	100
1	D	246/283 (87%)	236 (96%)	9 (4%)	1 (0%)	34	37
All	All	976/1132 (86%)	938 (96%)	37 (4%)	1 (0%)	51	60

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	216	VAL

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	204/237 (86%)	198 (97%)	6 (3%)	42	54
1	B	204/237 (86%)	191 (94%)	13 (6%)	17	20
1	C	207/237 (87%)	194 (94%)	13 (6%)	18	20
1	D	207/237 (87%)	200 (97%)	7 (3%)	37	47
All	All	822/948 (87%)	783 (95%)	39 (5%)	26	33

All (39) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	LYS
1	A	147	GLN
1	A	151	ARG
1	A	247	GLU
1	A	248	THR
1	A	256	GLU
1	B	24	ARG
1	B	28	TYR
1	B	57	LYS
1	B	85	GLU
1	B	102	VAL
1	B	118	GLU
1	B	146	ILE
1	B	173	SER
1	B	215	ILE
1	B	239	THR
1	B	243	GLU
1	B	247	GLU
1	B	248	THR
1	C	14	MET
1	C	24	ARG
1	C	71	VAL
1	C	75	LYS
1	C	127	VAL
1	C	142	GLN
1	C	143	VAL
1	C	159	GLU
1	C	214	TYR
1	C	236	ILE
1	C	246	LYS
1	C	251	ILE
1	C	253	ARG
1	D	147	GLN
1	D	151	ARG
1	D	163	GLU
1	D	198	LYS
1	D	215	ILE
1	D	246	LYS
1	D	247	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	158	HIS
1	B	147	GLN
1	C	70	GLN
1	D	84	ASN
1	D	158	HIS

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 18 ligands modelled in this entry, 18 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, 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	244/283 (86%)	-0.06	10 (4%) 37 35	17, 26, 55, 86	0
1	B	244/283 (86%)	0.24	14 (5%) 23 22	19, 35, 68, 97	0
1	C	248/283 (87%)	0.26	12 (4%) 30 29	19, 32, 74, 103	0
1	D	248/283 (87%)	0.29	28 (11%) 5 4	19, 40, 77, 100	0
All	All	984/1132 (86%)	0.18	64 (6%) 18 17	17, 34, 71, 103	0

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	255	VAL	5.5
1	B	249	GLU	4.8
1	A	256	GLU	4.6
1	C	260	ARG	4.4
1	B	256	GLU	4.3
1	C	253	ARG	4.3
1	B	253	ARG	4.1
1	C	259	GLN	4.1
1	D	147	GLN	3.9
1	C	256	GLU	3.7
1	D	170	GLU	3.6
1	D	28	TYR	3.6
1	C	258	MET	3.6
1	C	146	ILE	3.5
1	B	243	GLU	3.4
1	D	171	GLY	3.3
1	D	249	GLU	3.3
1	A	147	GLN	3.3
1	B	147	GLN	3.2
1	D	94	ASP	3.2
1	C	212	LEU	3.2

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Mol	Chain	Res	Type	RSRZ
1	D	250	GLU	3.1
1	B	171	GLY	3.1
1	A	253	ARG	3.1
1	D	259	GLN	3.1
1	C	147	GLN	3.0
1	B	252	LEU	3.0
1	D	253	ARG	2.9
1	D	169	LEU	2.9
1	D	163	GLU	2.8
1	D	255	VAL	2.7
1	A	250	GLU	2.7
1	C	246	LYS	2.6
1	D	13	LYS	2.6
1	C	148	GLY	2.6
1	A	214	TYR	2.6
1	C	214	TYR	2.6
1	D	246	LYS	2.5
1	D	174	VAL	2.5
1	B	235	GLU	2.4
1	A	246	LYS	2.4
1	D	173	SER	2.4
1	D	256	GLU	2.4
1	D	212	LEU	2.3
1	B	170	GLU	2.3
1	D	145	GLU	2.3
1	D	214	TYR	2.3
1	B	174	VAL	2.3
1	D	92	PRO	2.3
1	A	249	GLU	2.2
1	D	146	ILE	2.2
1	B	28	TYR	2.2
1	B	250	GLU	2.2
1	A	252	LEU	2.2
1	B	255	VAL	2.2
1	D	26	ASP	2.1
1	D	150	PRO	2.1
1	A	251	ILE	2.1
1	D	243	GLU	2.1
1	D	96	HIS	2.0
1	D	258	MET	2.0
1	D	151	ARG	2.0
1	B	214	TYR	2.0

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Mol	Chain	Res	Type	RSRZ
1	C	245	ALA	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 monosaccharides 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
2	AU	A	304	1/1	0.80	0.07	74,74,74,74	1
2	AU	B	304	1/1	0.83	0.22	97,97,97,97	1
2	AU	D	305	1/1	0.88	0.09	99,99,99,99	1
2	AU	B	305	1/1	0.90	0.07	93,93,93,93	1
2	AU	D	304	1/1	0.92	0.12	70,70,70,70	1
2	AU	D	302	1/1	0.93	0.04	99,99,99,99	1
2	AU	C	304	1/1	0.94	0.11	89,89,89,89	1
2	AU	B	301	1/1	0.94	0.05	79,79,79,79	1
2	AU	B	302	1/1	0.94	0.12	67,67,67,67	1
2	AU	C	302	1/1	0.94	0.10	56,56,56,56	1
2	AU	B	303	1/1	0.95	0.14	65,65,65,65	1
2	AU	A	302	1/1	0.96	0.13	58,58,58,58	1
2	AU	A	301	1/1	0.96	0.09	52,52,52,52	1
2	AU	D	303	1/1	0.97	0.07	82,82,82,82	1
2	AU	D	301	1/1	0.97	0.06	97,97,97,97	1
2	AU	C	303	1/1	0.97	0.14	58,58,58,58	1
2	AU	C	301	1/1	0.98	0.07	57,57,57,57	1
2	AU	A	303	1/1	0.99	0.09	63,63,63,63	1

6.5 Other polymers [i](#)

There are no such residues in this entry.