wwPDB X-ray Structure Validation Summary Report (i)

Jan 31, 2016 – 11:54 PM GMT

PDB ID	:	1YZ9
Title	:	Crystal structure of RNase III mutant E110Q from Aquifex aeolicus complexed with double stranded RNA at 2.1-Angstrom Resolution
Authors	:	Gan, J.; Tropea, J.E.; Austin, B.P.; Court, D.L.; Waugh, D.S.; Ji, X.
Deposited on	:	2005-02-28
Resolution	:	2.10 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:

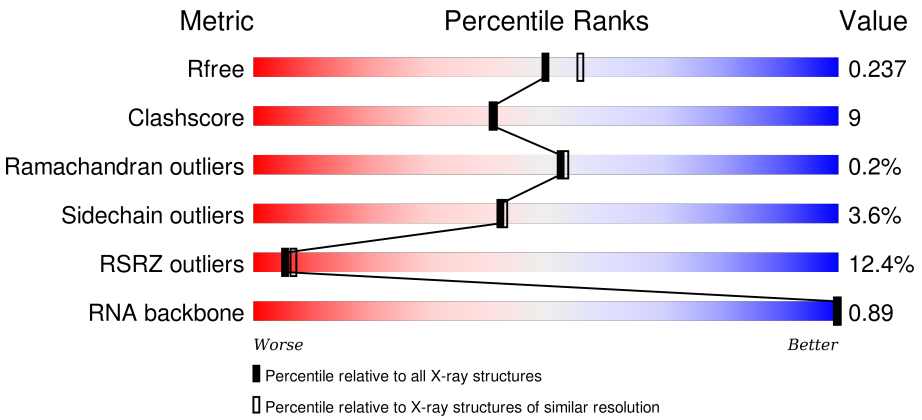
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	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 2.10 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	3939 (2.10-2.10)
Clashscore	102246	4460 (2.10-2.10)
Ramachandran outliers	100387	4413 (2.10-2.10)
Sidechain outliers	100360	4414 (2.10-2.10)
RSRZ outliers	91569	3948 (2.10-2.10)
RNA backbone	2183	1118 (2.80-1.40)

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 >=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	C	11	9%, 82%, 18%
1	D	11	100%
1	E	11	91%, 9%
1	F	11	9%, 100%

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Mol	Chain	Length	Quality of chain
2	A	221	8% 78% 20%
2	B	221	18% 73% 22%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	SO4	B	1005	-	-	-	X

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 4999 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 RNA chain called 5'-R(*CP*GP*AP*AP*CP*UP*UP*CP*GP*CP*G)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	C	11	230	104	41	75	10	0	0	0
1	D	11	230	104	41	75	10	0	0	0
1	E	11	230	104	41	75	10	0	0	0
1	F	11	230	104	41	75	10	0	0	0

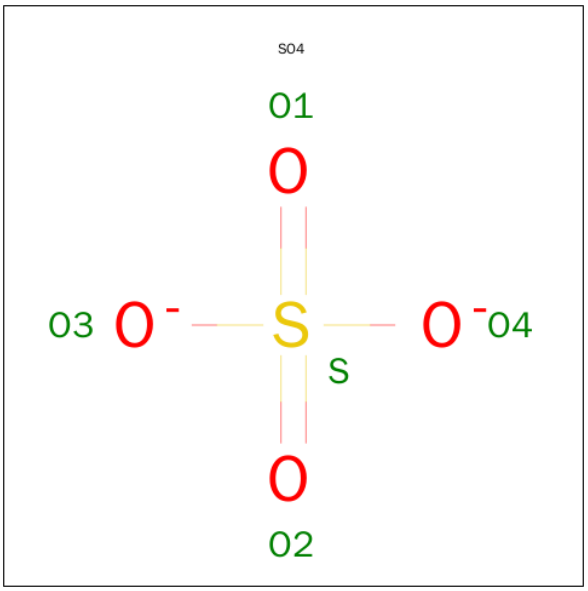
- Molecule 2 is a protein called Ribonuclease III.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	A	220	1837	1196	308	331	2	0	0	0
2	B	218	1820	1185	305	329	1	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	110	GLN	GLU	ENGINEERED	UNP O67082
B	110	GLN	GLU	ENGINEERED	UNP O67082

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total O S 5 4 1	0	0
3	E	1	Total O S 5 4 1	0	0
3	D	1	Total O S 5 4 1	0	0
3	A	1	Total O S 5 4 1	0	0
3	B	1	Total O S 5 4 1	0	0
3	A	1	Total O S 5 4 1	0	0
3	B	1	Total O S 5 4 1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	168	Total O 168 168	0	0
4	B	122	Total O 122 122	0	0
4	C	36	Total O 36 36	0	0
4	D	16	Total O 16 16	0	0
4	E	15	Total O 15 15	0	0

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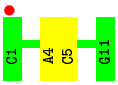
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	F	30	30	30	0	0

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: 5'-R(*CP*GP*AP*AP*CP*UP*UP*CP*GP*CP*G)-3'

Chain C:



- Molecule 1: 5'-R(*CP*GP*AP*AP*CP*UP*UP*CP*GP*CP*G)-3'

Chain D:

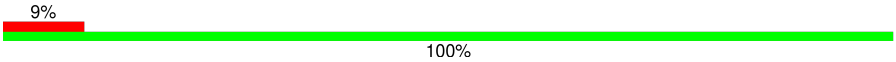
There are no outlier residues recorded for this chain.

- Molecule 1: 5'-R(*CP*GP*AP*AP*CP*UP*UP*CP*GP*CP*G)-3'

Chain E:

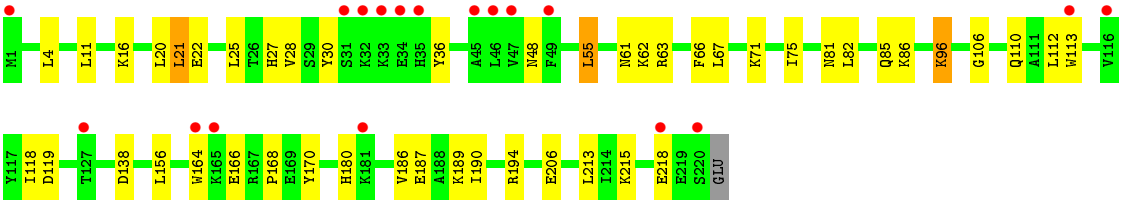
- Molecule 1: 5'-R(*CP*GP*AP*AP*CP*UP*UP*CP*GP*CP*G)-3'

Chain F:



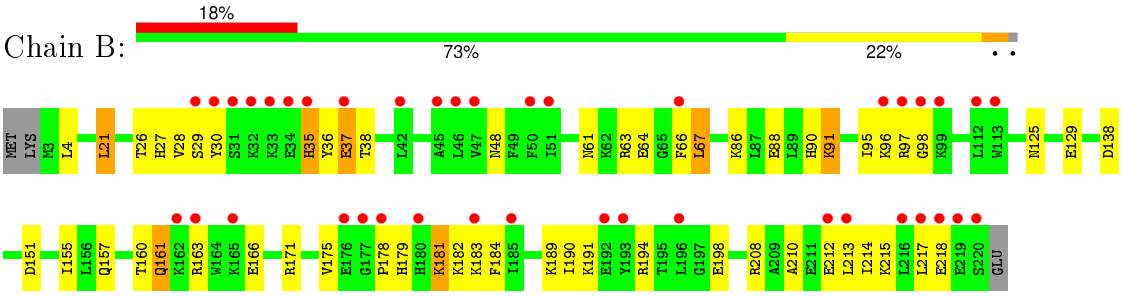
- Molecule 2: Ribonuclease III

Chain A:



- Molecule 2: Ribonuclease III

Chain B:


18%
73%
22%
MET LYS M3 L4 L21 T26 H27 V28 S29 Y30 S31 K32 K33 E34 H35 Y36 E37 T38 L42 A45 L46 V47 N48 F49 F50 I51 N61 K62 R63 E64 G65 F66 L67 K86 L87 E88 L89 H90 K91 I95 K96 R97 G98 K99 L112 W113 N125 E129 D138
D151 I155 L156 Q157 T160 Q161 K162 R163 W164 K165 E166 R171 V175 E176 G177 P178 H179 H180 K181 K182 K183 F184 I185 K189 I190 K191 E192 Y193 R194 T195 L196 G197 E198 R208 A209 A210 E211 E212 L213 I214 K215 L216 L217 E218 E219 S220 GLU

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	60.59Å 118.36Å 61.90Å 90.00° 99.45° 90.00°	Depositor
Resolution (Å)	29.88 – 2.10 29.88 – 2.10	Depositor EDS
% Data completeness (in resolution range)	85.3 (29.88-2.10) 85.0 (29.88-2.10)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.14 (at 2.10Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.208 , 0.238 0.208 , 0.237	Depositor DCC
R_{free} test set	2145 reflections (5.01%)	DCC
Wilson B-factor (Å^2)	42.6	Xtriage
Anisotropy	0.148	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 55.1	EDS
Estimated twinning fraction	0.018 for l,-k,h	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Outliers	0 of 43496 reflections	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	4999	wwPDB-VP
Average B, all atoms (Å^2)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.34% 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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

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	C	0.30	0/256	0.64	0/397
1	D	0.26	0/256	0.64	0/397
1	E	0.24	0/256	0.69	0/397
1	F	0.31	0/256	0.67	0/397
2	A	0.37	0/1872	0.54	1/2503 (0.0%)
2	B	0.34	0/1855	0.56	0/2482
All	All	0.34	0/4751	0.58	1/6573 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	113	TRP	CA-CB-CG	-5.44	103.37	113.70

There are no chirality outliers.

There are no planarity outliers.

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	C	230	0	121	1	0
1	D	230	0	121	0	0
1	E	230	0	121	1	0
1	F	230	0	121	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	1837	0	1907	30	0
2	B	1820	0	1882	47	0
3	A	15	0	0	0	0
3	B	10	0	0	0	0
3	D	5	0	0	0	0
3	E	5	0	0	0	0
4	A	168	0	0	2	0
4	B	122	0	0	3	0
4	C	36	0	0	0	0
4	D	16	0	0	0	0
4	E	15	0	0	0	0
4	F	30	0	0	0	0
All	All	4999	0	4273	76	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 9.

The worst 5 of 76 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:A:30:TYR:HA	2:A:96:LYS:HG3	1.30	1.09
2:B:30:TYR:HA	2:B:96:LYS:HB2	1.61	0.83
2:B:35:HIS:CD2	2:B:37:GLU:HG2	2.17	0.80
2:B:179:HIS:HA	2:B:182:LYS:HE2	1.63	0.80
2:B:88:GLU:HB3	2:B:91:LYS:HD2	1.69	0.75

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	
2	A	218/221 (99%)	212 (97%)	6 (3%)	0	100	100
2	B	216/221 (98%)	210 (97%)	5 (2%)	1 (0%)	34	30
All	All	434/442 (98%)	422 (97%)	11 (2%)	1 (0%)	52	53

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	98	GLY

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	
2	A	197/198 (100%)	191 (97%)	6 (3%)	48	51
2	B	195/198 (98%)	187 (96%)	8 (4%)	37	36
All	All	392/396 (99%)	378 (96%)	14 (4%)	42	43

5 of 14 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	21	LEU
2	B	35	HIS
2	B	161	GLN
2	A	218	GLU
2	B	91	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
2	A	57	GLN
2	A	85	GLN
2	A	110	GLN
2	B	161	GLN

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	C	10/11 (90%)	0	0
1	D	10/11 (90%)	0	0
1	E	10/11 (90%)	0	0
1	F	10/11 (90%)	0	0
All	All	40/44 (90%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

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)

7 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	$\#\|Z\| > 2$
3	SO4	A	1001	-	4,4,4	0.22	0	6,6,6	0.09	0
3	SO4	A	1004	-	4,4,4	0.26	0	6,6,6	0.10	0
3	SO4	A	1006	-	4,4,4	0.25	0	6,6,6	0.06	0
3	SO4	B	1005	-	4,4,4	0.22	0	6,6,6	0.09	0
3	SO4	B	1007	-	4,4,4	0.27	0	6,6,6	0.08	0
3	SO4	D	1003	-	4,4,4	0.20	0	6,6,6	0.12	0
3	SO4	E	1002	-	4,4,4	0.24	0	6,6,6	0.11	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
3	SO4	A	1001	-	-	0/0/0/0	0/0/0/0
3	SO4	A	1004	-	-	0/0/0/0	0/0/0/0
3	SO4	A	1006	-	-	0/0/0/0	0/0/0/0
3	SO4	B	1005	-	-	0/0/0/0	0/0/0/0
3	SO4	B	1007	-	-	0/0/0/0	0/0/0/0
3	SO4	D	1003	-	-	0/0/0/0	0/0/0/0
3	SO4	E	1002	-	-	0/0/0/0	0/0/0/0

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 (i)

6.1 Protein, DNA and RNA chains (i)

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	C	11/11 (100%)	0.31	1 (9%)	11	16	30, 38, 68, 86	0
1	D	11/11 (100%)	-0.07	0	100	100	37, 43, 74, 79	0
1	E	11/11 (100%)	-0.19	0	100	100	44, 49, 67, 68	0
1	F	11/11 (100%)	0.12	1 (9%)	11	16	37, 40, 67, 74	0
2	A	220/221 (99%)	0.51	18 (8%)	14	20	27, 43, 82, 99	0
2	B	218/221 (98%)	0.92	40 (18%)	2	2	28, 52, 94, 100	0
All	All	482/486 (99%)	0.65	60 (12%)	5	7	27, 47, 88, 100	0

The worst 5 of 60 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	97	ARG	8.6
2	A	33	LYS	8.1
2	B	98	GLY	6.8
2	A	32	LYS	5.9
2	B	220	SER	5.9

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 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, 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	LLDF	B-factors(Å^2)	Q<0.9
3	SO4	B	1005	5/5	0.88	0.20	2.20	80,80,81,86	5
3	SO4	A	1001	5/5	0.94	0.07	-2.73	84,86,92,93	0
3	SO4	B	1007	5/5	0.76	0.16	-	89,90,94,96	5
3	SO4	A	1004	5/5	0.90	0.27	-	78,79,83,83	5
3	SO4	E	1002	5/5	0.95	0.13	-	67,83,85,87	0
3	SO4	D	1003	5/5	0.87	0.24	-	81,85,89,96	0
3	SO4	A	1006	5/5	0.87	0.28	-	95,96,99,99	5

6.5 Other polymers (i)

There are no such residues in this entry.