Full wwPDB X-ray Structure Validation Report ⓘ

May 22, 2020 – 09:16 pm BST

PDB ID	:	4YAM
Title	:	Crystal structure of LigE-apo form from Sphingobium sp. strain SYK-6
Authors	:	Pereira, J.H.; McAndrew, R.P.; Heins, R.A.; Sale, K.L.; Simmons, B.A.; Adams, P.D.
Deposited on	:	2015-02-17
Resolution	:	1.91 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 following versions of software and data (see references ⓘ) were used in the production of this report:

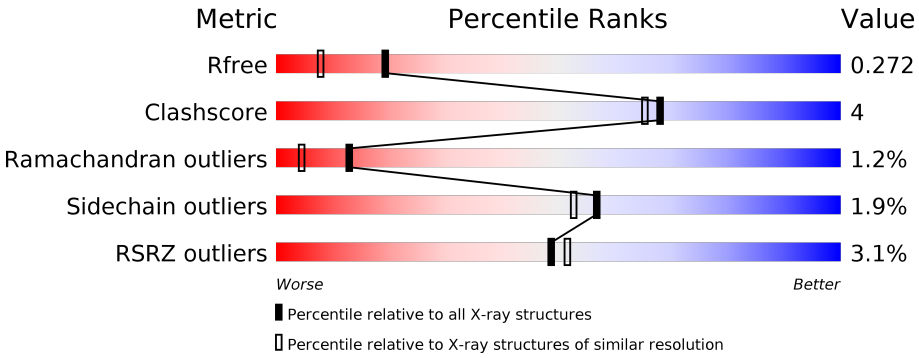
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 1.91 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	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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 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 <=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	281	3% 77% 10% • 11%
1	B	281	4% 81% 7% • 10%
1	C	281	4% 81% 8% • 10%
1	D	281	82% 7% 11%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 17330 atoms, of which 7925 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 Beta-etherase.

Mol	Chain	Residues	Atoms							ZeroOcc	AltConf	Trace
1	A	250	Total	C	H	N	O	S	Se	0	0	0
			4038	1328	1980	352	373	2	3			
1	B	252	Total	C	H	N	O	S	Se	0	0	0
			4049	1333	1984	351	376	2	3			
1	C	252	Total	C	H	N	O	S	Se	0	0	0
			4049	1333	1984	351	376	2	3			
1	D	251	Total	C	H	N	O	S	Se	0	0	0
			4035	1328	1977	350	375	2	3			

- Molecule 2 is water.

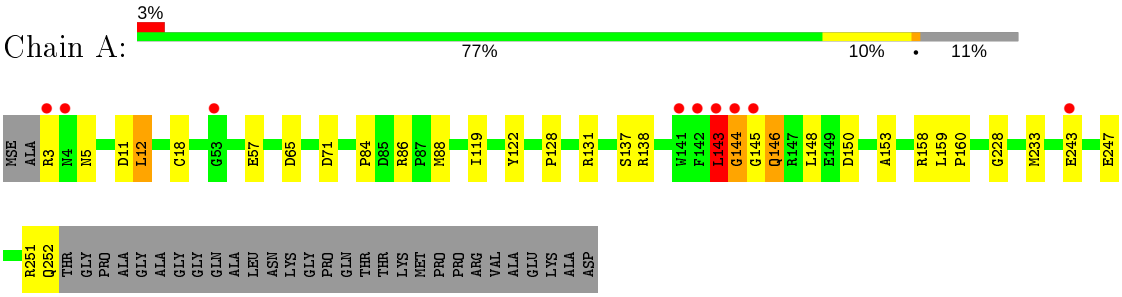
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	297	Total	O	0	0
			297	297		
2	B	303	Total	O	0	0
			303	303		
2	C	262	Total	O	0	0
			262	262		
2	D	297	Total	O	0	0
			297	297		

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 the various outlier classes 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.

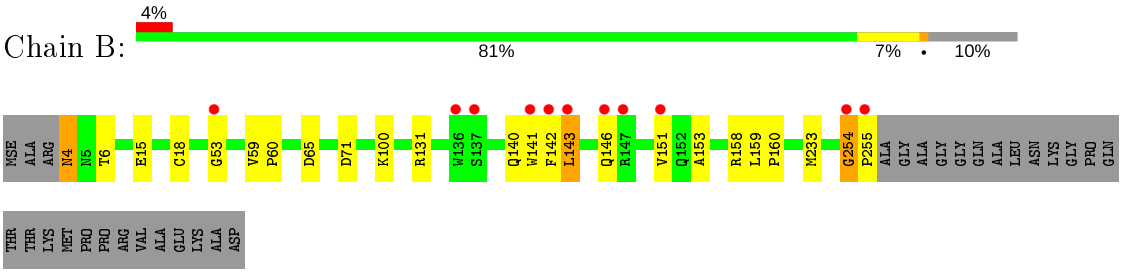
- Molecule 1: Beta-etherase

Chain A:



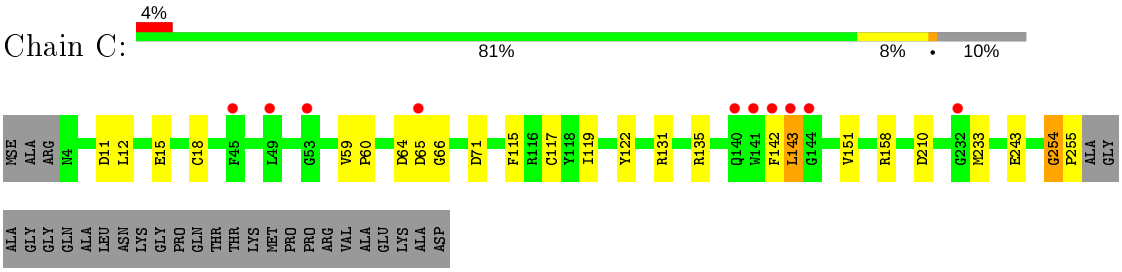
- Molecule 1: Beta-etherase

Chain B:



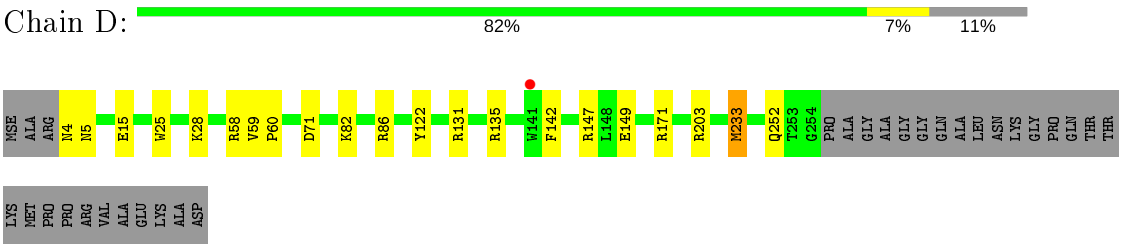
- Molecule 1: Beta-etherase

Chain C:



- Molecule 1: Beta-etherase

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	122.56Å 97.16Å 131.39Å 90.00° 106.65° 90.00°	Depositor
Resolution (Å)	50.00 – 1.91 48.58 – 1.91	Depositor EDS
% Data completeness (in resolution range)	99.2 (50.00-1.91) 95.4 (48.58-1.91)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.02 (at 1.91Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.3_1479)	Depositor
R, R_{free}	0.227 , 0.271 0.230 , 0.272	Depositor DCC
R_{free} test set	2000 reflections (1.75%)	wwPDB-VP
Wilson B-factor (Å^2)	20.4	Xtriage
Anisotropy	0.351	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 56.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.45$, $< L^2 > = 0.27$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	17330	wwPDB-VP
Average B, all atoms (Å^2)	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.77% 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

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	0.29	0/2121	0.52	0/2887
1	B	0.27	0/2129	0.46	0/2900
1	C	0.27	0/2129	0.46	0/2900
1	D	0.27	0/2121	0.47	0/2888
All	All	0.27	0/8500	0.48	0/11575

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	B	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	146	GLN	Peptide

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	2058	1980	1983	22	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2065	1984	1987	14	0
1	C	2065	1984	1987	13	0
1	D	2058	1977	1980	12	1
2	A	297	0	0	3	0
2	B	303	0	0	4	0
2	C	262	0	0	2	0
2	D	297	0	0	7	0
All	All	9405	7925	7937	61	1

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 (61) 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:153:ALA:O	1:A:158:ARG:NH2	2.17	0.77
1:B:53:GLY:N	2:B:301:HOH:O	2.16	0.77
1:D:25:TRP:O	2:D:566:HOH:O	2.05	0.74
1:A:228:GLY:O	2:A:505:HOH:O	2.11	0.68
1:C:210:ASP:OD1	2:C:497:HOH:O	2.13	0.67
1:C:151:VAL:O	1:C:158:ARG:NH2	2.28	0.67
1:D:203:ARG:NH1	2:D:506:HOH:O	2.28	0.66
1:D:135:ARG:NE	2:D:301:HOH:O	2.32	0.61
1:A:65:ASP:OD2	2:A:590:HOH:O	2.16	0.59
1:A:18:CYS:SG	1:A:233:MSE:SE	3.11	0.59
1:C:131:ARG:NH1	2:C:426:HOH:O	2.35	0.58
1:B:15:GLU:OE1	1:B:131:ARG:NH2	2.36	0.58
1:A:143:LEU:HA	1:A:145:GLY:N	2.20	0.56
1:C:18:CYS:SG	1:C:233:MSE:SE	3.14	0.56
1:A:247:GLU:N	1:A:247:GLU:OE1	2.39	0.55
1:A:143:LEU:HA	1:A:144:GLY:C	2.26	0.55
1:B:153:ALA:O	1:B:158:ARG:NH2	2.39	0.55
1:D:4:ASN:N	2:D:553:HOH:O	2.39	0.54
1:D:28:LYS:HB2	2:D:566:HOH:O	2.09	0.53
1:B:18:CYS:SG	1:B:233:MSE:SE	3.16	0.53
1:B:151:VAL:O	1:B:158:ARG:NH2	2.41	0.53
1:B:142:PHE:N	1:B:143:LEU:HA	2.24	0.52
1:D:15:GLU:OE1	1:D:131:ARG:NH2	2.42	0.52
1:D:135:ARG:NH2	1:D:149:GLU:OE2	2.43	0.51
1:C:15:GLU:OE1	1:C:131:ARG:NH2	2.45	0.50
1:A:137:SER:OG	1:A:138:ARG:NH1	2.44	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:11:ASP:OD1	1:A:12:LEU:N	2.43	0.50
1:C:254:GLY:H	1:C:255:PRO:CD	2.24	0.49
1:D:82:LYS:NZ	2:D:302:HOH:O	2.45	0.48
1:A:143:LEU:HA	1:A:145:GLY:CA	2.45	0.47
1:A:3:ARG:HB3	1:A:65:ASP:OD1	2.15	0.46
1:A:5:ASN:OD1	1:A:86:ARG:NH2	2.42	0.46
1:B:141:TRP:NE1	2:B:425:HOH:O	2.36	0.46
1:A:86:ARG:O	1:A:88:MSE:HE2	2.16	0.46
1:B:254:GLY:H	1:B:255:PRO:HD3	1.82	0.45
1:D:5:ASN:OD1	1:D:86:ARG:NH2	2.48	0.45
1:A:84:PRO:HA	1:A:88:MSE:HE1	1.99	0.45
1:C:11:ASP:OD1	1:C:12:LEU:N	2.50	0.44
1:A:158:ARG:NE	2:A:391:HOH:O	2.49	0.44
1:B:4:ASN:CA	1:B:6:THR:H	2.31	0.44
1:C:254:GLY:H	1:C:255:PRO:HD3	1.81	0.44
1:C:59:VAL:HB	1:C:60:PRO:HA	2.00	0.44
1:D:171:ARG:NH2	2:D:417:HOH:O	2.50	0.44
1:B:140:GLN:OE1	2:B:445:HOH:O	2.20	0.43
1:C:64:ASP:O	1:C:66:GLY:N	2.52	0.43
1:B:100:LYS:NZ	2:B:489:HOH:O	2.36	0.43
1:A:84:PRO:C	1:A:88:MSE:HE1	2.39	0.43
1:A:119:ILE:HG13	1:A:148:LEU:HD22	2.00	0.42
1:A:243:GLU:OE1	1:A:243:GLU:N	2.50	0.42
1:B:142:PHE:N	1:B:143:LEU:CA	2.83	0.42
1:D:59:VAL:HB	1:D:60:PRO:HA	2.01	0.42
1:B:59:VAL:HB	1:B:60:PRO:HA	2.02	0.42
1:B:159:LEU:N	1:B:160:PRO:CD	2.84	0.41
1:C:115:PHE:CZ	1:C:119:ILE:HD13	2.55	0.41
1:A:143:LEU:HD12	1:A:145:GLY:HA2	2.03	0.41
1:A:159:LEU:N	1:A:160:PRO:CD	2.84	0.41
1:C:117:CYS:SG	1:C:158:ARG:NH1	2.94	0.40
1:C:143:LEU:HD11	1:C:151:VAL:HG21	2.03	0.40
1:D:25:TRP:CZ2	1:D:233:MSE:HE1	2.55	0.40
1:A:128:PRO:HA	1:A:131:ARG:HG3	2.03	0.40
1:A:57:GLU:N	1:A:57:GLU:OE1	2.48	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:150:ASP:OD1	1:D:147:ARG:NH2[4_456]	2.17	0.03

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	248/281 (88%)	238 (96%)	6 (2%)	4 (2%)	9 2
1	B	250/281 (89%)	238 (95%)	9 (4%)	3 (1%)	13 4
1	C	250/281 (89%)	239 (96%)	7 (3%)	4 (2%)	9 2
1	D	249/281 (89%)	240 (96%)	8 (3%)	1 (0%)	34 24
All	All	997/1124 (89%)	955 (96%)	30 (3%)	12 (1%)	13 4

All (12) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	143	LEU
1	A	144	GLY
1	A	146	GLN
1	B	65	ASP
1	C	65	ASP
1	C	254	GLY
1	C	135	ARG
1	A	71	ASP
1	C	71	ASP
1	B	71	ASP
1	B	254	GLY
1	D	71	ASP

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	219/235 (93%)	213 (97%)	6 (3%)	44	38
1	B	220/235 (94%)	218 (99%)	2 (1%)	78	79
1	C	220/235 (94%)	216 (98%)	4 (2%)	59	55
1	D	219/235 (93%)	214 (98%)	5 (2%)	50	45
All	All	878/940 (93%)	861 (98%)	17 (2%)	57	53

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	12	LEU
1	A	122	TYR
1	A	143	LEU
1	A	146	GLN
1	A	251	ARG
1	A	252	GLN
1	B	4	ASN
1	B	143	LEU
1	C	122	TYR
1	C	142	PHE
1	C	143	LEU
1	C	243	GLU
1	D	58	ARG
1	D	122	TYR
1	D	142	PHE
1	D	233	MSE
1	D	252	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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

There are no carbohydrates in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

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^{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	247/281 (87%)	0.11	9 (3%)	42	45	13, 22, 46, 80	0
1	B	249/281 (88%)	0.11	11 (4%)	34	37	13, 27, 54, 83	0
1	C	249/281 (88%)	0.18	10 (4%)	38	41	15, 29, 55, 93	0
1	D	248/281 (88%)	0.10	1 (0%)	92	93	14, 26, 47, 63	0
All	All	993/1124 (88%)	0.12	31 (3%)	49	51	13, 26, 51, 93	0

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	142	PHE	7.1
1	A	143	LEU	6.0
1	C	141	TRP	5.8
1	B	141	TRP	5.8
1	C	142	PHE	5.3
1	B	143	LEU	4.6
1	A	144	GLY	4.5
1	A	4	ASN	4.1
1	C	140	GLN	3.9
1	B	151	VAL	3.9
1	A	243	GLU	3.8
1	B	146	GLN	3.8
1	B	136	TRP	3.4
1	C	53	GLY	3.0
1	A	142	PHE	2.8
1	A	145	GLY	2.8
1	A	141	TRP	2.8
1	C	45	PHE	2.7
1	C	143	LEU	2.7
1	B	137	SER	2.7
1	B	147	ARG	2.5

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Mol	Chain	Res	Type	RSRZ
1	C	65	ASP	2.4
1	B	53	GLY	2.4
1	A	3	ARG	2.4
1	B	254	GLY	2.3
1	C	232	GLY	2.3
1	A	53	GLY	2.2
1	C	144	GLY	2.1
1	D	141	TRP	2.1
1	B	255	PRO	2.1
1	C	49	LEU	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 carbohydrates in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.