Full wwPDB X-ray Structure Validation Report ⓘ

Apr 19, 2022 – 10:02 AM EDT

PDB ID	:	7RPQ
Title	:	Crystal Structure of carboxyl-terminal processing protease A, CtpA, of Pseudomonas aeruginosa
Authors	:	Hsu, H.C.; Li, H.
Deposited on	:	2021-08-04
Resolution	:	3.30 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:

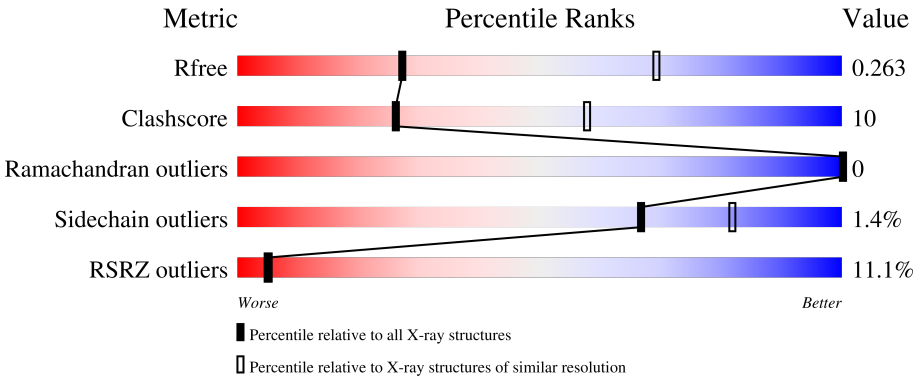
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.27
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.27

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 3.30 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	1149 (3.34-3.26)
Clashscore	141614	1205 (3.34-3.26)
Ramachandran outliers	138981	1183 (3.34-3.26)
Sidechain outliers	138945	1182 (3.34-3.26)
RSRZ outliers	127900	1115 (3.34-3.26)

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 <=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	403	6% 48% 16% 36%
1	B	403	8% 47% 16% 36%

2 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 3933 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 Probable carboxyl-terminal protease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	258	Total	C	N	O	Se	0	0	0
			1963	1234	345	382	2			
1	B	258	Total	C	N	O	Se	0	0	0
			1970	1238	348	382	2			

There are 8 discrepancies between the modelled and reference sequences:

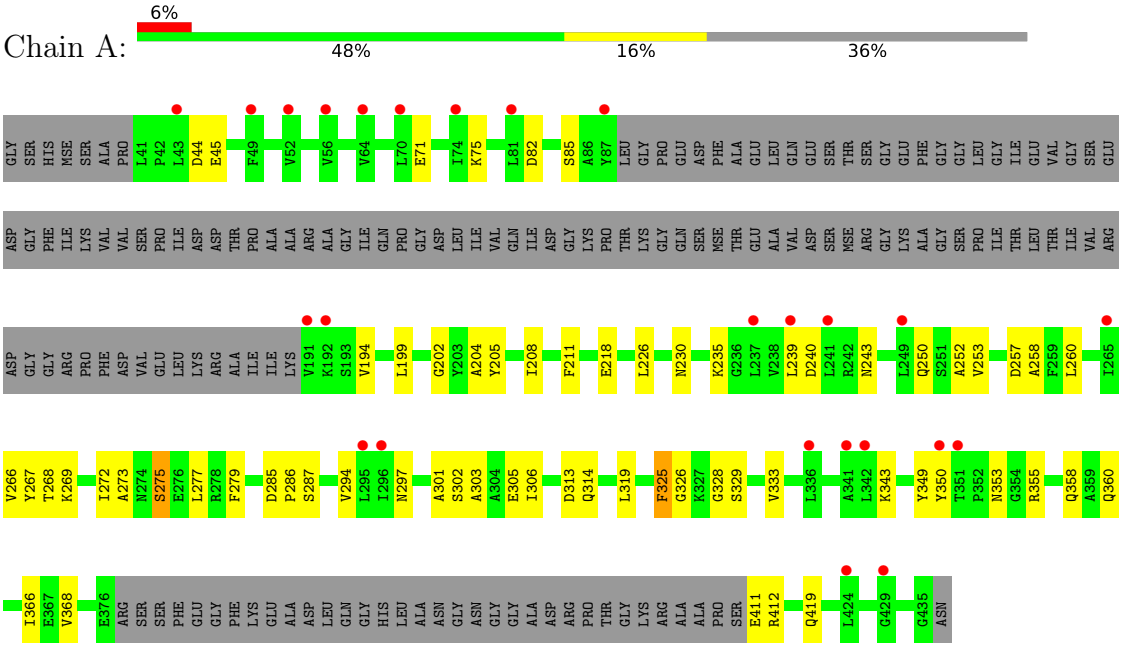
Chain	Residue	Modelled	Actual	Comment	Reference
A	34	GLY	-	expression tag	UNP Q9HU50
A	35	SER	-	expression tag	UNP Q9HU50
A	36	HIS	-	expression tag	UNP Q9HU50
A	37	MSE	-	expression tag	UNP Q9HU50
B	34	GLY	-	expression tag	UNP Q9HU50
B	35	SER	-	expression tag	UNP Q9HU50
B	36	HIS	-	expression tag	UNP Q9HU50
B	37	MSE	-	expression tag	UNP Q9HU50

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

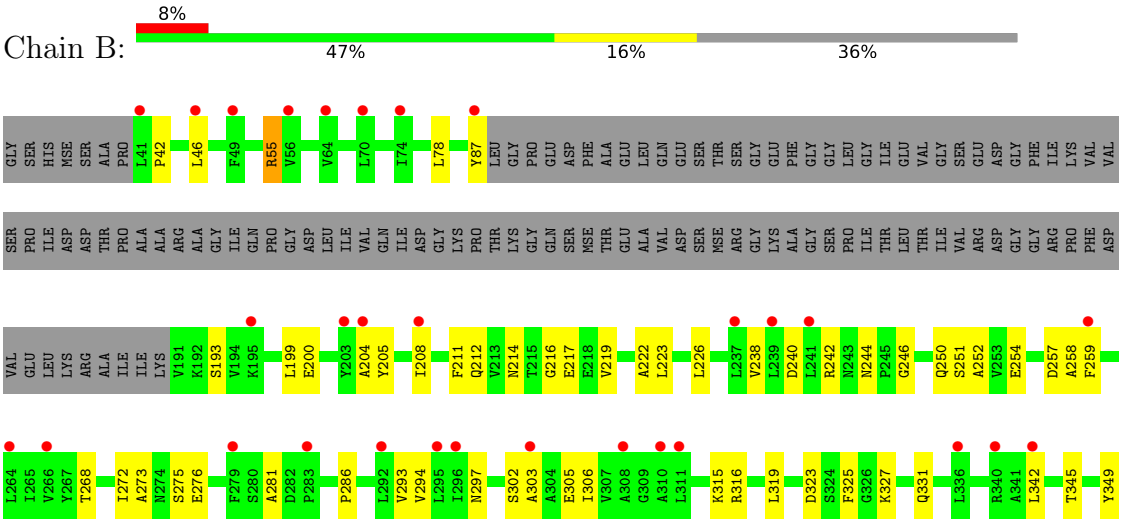
• Molecule 1: Probable carboxyl-terminal protease

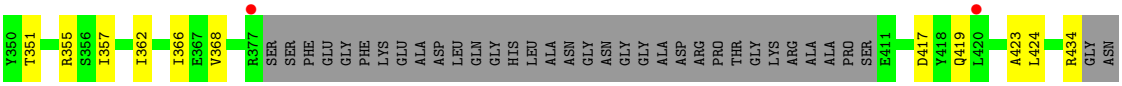
Chain A:



• Molecule 1: Probable carboxyl-terminal protease

Chain B:




Y350
T351
R355
S356
I357
I362
I366
E367
V368
R377
SER
SER
PHE
GLU
GLY
PHE
LYS
GLU
ALA
ASP
LEU
GLN
GLY
HIS
LEU
ALA
ASN
GLY
ASN
GLY
GLY
ALA
ASP
ARG
PRO
THR
GLY
LYS
ARG
ALA
ALA
PRO
SER
E411
D417
Y418
Q419
L420
A423
L424
R434
GLY
ASN

4 Data and refinement statistics (i)

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α, β, γ	187.49Å 187.49Å 132.01Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	39.83 – 3.30 39.83 – 3.30	Depositor EDS
% Data completeness (in resolution range)	100.0 (39.83-3.30) 99.9 (39.83-3.30)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.33 (at 3.32Å)	Xtriage
Refinement program	PHENIX (1.19_4092)	Depositor
R, R_{free}	0.236 , 0.264 0.236 , 0.263	Depositor DCC
R_{free} test set	1219 reflections (4.68%)	wwPDB-VP
Wilson B-factor (Å^2)	90.6	Xtriage
Anisotropy	0.079	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 65.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.39$, $< L^2 > = 0.21$	Xtriage
Estimated twinning fraction	0.160 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	3933	wwPDB-VP
Average B, all atoms (Å^2)	91.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.18% 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	0.28	0/1984	0.57	0/2682
1	B	0.27	0/1991	0.55	0/2691
All	All	0.27	0/3975	0.56	0/5373

There are no bond length outliers.

There are no bond angle outliers.

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	1963	0	2021	40	0
1	B	1970	0	2031	44	0
All	All	3933	0	4052	83	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 10.

All (83) 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:44:ASP:OD1	1:A:45:GLU:N	2.21	0.73
1:A:260:LEU:HD21	1:A:314:GLN:HG3	1.78	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:258:ALA:HA	1:B:286:PRO:HD2	1.79	0.64
1:A:302:SER:OG	1:A:303:ALA:N	2.31	0.63
1:B:199:LEU:HD23	1:B:205:TYR:HB2	1.82	0.62
1:A:328:GLY:H	1:A:358:GLN:HG2	1.66	0.61
1:B:242:ARG:NH2	1:B:417:ASP:OD2	2.32	0.61
1:B:294:VAL:HB	1:B:319:LEU:HD22	1.83	0.61
1:A:204:ALA:HB1	1:A:226:LEU:HD13	1.85	0.58
1:B:293:VAL:HG11	1:B:423:ALA:HB1	1.86	0.57
1:B:259:PHE:O	1:B:316:ARG:NH1	2.37	0.57
1:B:331:GLN:HG3	1:B:345:THR:HG22	1.86	0.57
1:B:214:ASN:O	1:B:217:GLU:HG2	2.05	0.57
1:B:252:ALA:HB2	1:B:303:ALA:HB1	1.88	0.55
1:A:267:TYR:HE2	1:A:269:LYS:HE2	1.72	0.55
1:B:242:ARG:HB2	1:B:297:ASN:HB2	1.89	0.55
1:A:355:ARG:HH11	1:A:360:GLN:HG2	1.72	0.54
1:A:258:ALA:HA	1:A:286:PRO:HD2	1.90	0.53
1:B:204:ALA:HB1	1:B:226:LEU:HD13	1.89	0.53
1:A:333:VAL:HG22	1:A:343:LYS:HG3	1.90	0.53
1:B:208:ILE:O	1:B:244:ASN:ND2	2.42	0.52
1:A:294:VAL:HB	1:A:319:LEU:HD22	1.91	0.52
1:B:351:THR:OG1	1:B:355:ARG:HG2	2.10	0.52
1:A:366:ILE:HG22	1:A:368:VAL:HG23	1.92	0.51
1:B:306:ILE:HD11	1:B:349:TYR:CD2	2.46	0.51
1:A:272:ILE:CG2	1:A:275:SER:HB2	2.42	0.50
1:A:411:GLU:HG2	1:A:412:ARG:H	1.75	0.50
1:B:219:VAL:O	1:B:223:LEU:HD13	2.12	0.49
1:A:199:LEU:HD11	1:A:205:TYR:HB2	1.93	0.49
1:B:366:ILE:HG22	1:B:368:VAL:HG23	1.93	0.49
1:A:194:VAL:HG23	1:A:208:ILE:HD13	1.95	0.48
1:B:242:ARG:CB	1:B:297:ASN:HB2	2.44	0.48
1:B:42:PRO:HD2	1:B:46:LEU:HD23	1.95	0.48
1:B:246:GLY:HA3	1:B:302:SER:HB3	1.96	0.48
1:B:272:ILE:HG22	1:B:275:SER:HB3	1.96	0.47
1:A:253:VAL:O	1:A:257:ASP:HB2	2.15	0.47
1:B:268:THR:O	1:B:276:GLU:HA	2.14	0.47
1:A:82:ASP:HB3	1:A:85:SER:OG	2.14	0.47
1:B:434:ARG:HD3	1:B:434:ARG:HA	1.58	0.47
1:A:268:THR:HG22	1:A:349:TYR:HD1	1.78	0.47
1:B:216:GLY:O	1:B:219:VAL:HG22	2.14	0.47
1:A:268:THR:HG22	1:A:349:TYR:CD1	2.50	0.46
1:A:305:GLU:OE2	1:A:326:GLY:N	2.32	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:302:SER:HB2	1:B:327:LYS:HE3	1.98	0.45
1:A:368:VAL:HG12	1:A:419:GLN:HG3	1.98	0.45
1:A:285:ASP:OD2	1:A:287:SER:OG	2.32	0.45
1:A:329:SER:HB3	1:A:358:GLN:HG3	1.98	0.45
1:A:266:VAL:HG21	1:A:306:ILE:HG12	1.99	0.45
1:A:301:ALA:HA	1:A:305:GLU:CD	2.37	0.45
1:B:199:LEU:HD12	1:B:200:GLU:N	2.30	0.45
1:B:238:VAL:HG13	1:B:293:VAL:HG13	1.98	0.45
1:A:272:ILE:HG12	1:A:273:ALA:H	1.82	0.45
1:A:243:ASN:OD1	1:A:297:ASN:ND2	2.39	0.44
1:B:193:SER:OG	1:B:212:GLN:OE1	2.35	0.44
1:B:205:TYR:CE1	1:B:240:ASP:HB2	2.51	0.44
1:B:342:LEU:HD12	1:B:342:LEU:O	2.17	0.44
1:B:305:GLU:HG2	1:B:362:ILE:HG12	1.99	0.44
1:B:199:LEU:HD11	1:B:424:LEU:HD13	2.00	0.44
1:A:272:ILE:HG22	1:A:275:SER:HB2	2.00	0.44
1:B:55:ARG:HD3	1:B:55:ARG:HA	1.73	0.44
1:A:202:GLY:N	1:A:230:ASN:OD1	2.46	0.43
1:A:205:TYR:CE1	1:A:240:ASP:HB2	2.53	0.43
1:B:78:LEU:HD12	1:B:87:TYR:HB2	2.00	0.43
1:B:272:ILE:HG12	1:B:273:ALA:H	1.83	0.43
1:B:305:GLU:OE2	1:B:357:ILE:HG23	2.17	0.43
1:A:277:LEU:HD13	1:A:279:PHE:CE2	2.54	0.43
1:A:301:ALA:HB2	1:A:325:PHE:HB3	2.01	0.43
1:A:71:GLU:O	1:A:75:LYS:HG3	2.20	0.42
1:A:211:PHE:CE2	1:A:252:ALA:HA	2.54	0.42
1:B:222:ALA:O	1:B:226:LEU:HG	2.20	0.42
1:B:257:ASP:OD1	1:B:281:ALA:HA	2.20	0.41
1:B:315:LYS:HE2	1:B:315:LYS:HB2	1.76	0.41
1:A:313:ASP:OD2	1:A:353:ASN:HB2	2.21	0.41
1:B:211:PHE:CE1	1:B:252:ALA:HA	2.56	0.41
1:A:194:VAL:HG12	1:A:218:GLU:HB3	2.02	0.41
1:A:326:GLY:O	1:A:358:GLN:HA	2.21	0.41
1:B:216:GLY:HA3	1:B:254:GLU:HG3	2.03	0.41
1:B:368:VAL:O	1:B:419:GLN:NE2	2.46	0.41
1:A:269:LYS:HB2	1:A:350:TYR:CE1	2.56	0.40
1:B:251:SER:HA	1:B:254:GLU:HG2	2.03	0.40
1:A:202:GLY:O	1:A:235:LYS:N	2.47	0.40
1:A:250:GLN:HG2	1:B:250:GLN:HG2	2.02	0.40
1:B:272:ILE:CG2	1:B:275:SER:HB3	2.51	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	252/403 (62%)	244 (97%)	8 (3%)	0	100	100
1	B	252/403 (62%)	244 (97%)	8 (3%)	0	100	100
All	All	504/806 (62%)	488 (97%)	16 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	214/319 (67%)	211 (99%)	3 (1%)	67	82
1	B	215/319 (67%)	212 (99%)	3 (1%)	67	82
All	All	429/638 (67%)	423 (99%)	6 (1%)	67	82

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	239	LEU
1	A	275	SER
1	A	325	PHE
1	B	55	ARG
1	B	323	ASP
1	B	325	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are

no such sidechains identified.

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates

There are no monosaccharides 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	256/403 (63%)	0.95	25 (9%) 7 7	53, 87, 132, 160	0
1	B	256/403 (63%)	0.98	32 (12%) 3 3	49, 85, 136, 160	0
All	All	512/806 (63%)	0.97	57 (11%) 5 5	49, 86, 133, 160	0

All (57) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	191	VAL	4.6
1	A	49	PHE	4.2
1	A	341	ALA	3.6
1	B	49	PHE	3.2
1	B	56	VAL	3.1
1	B	87	TYR	3.0
1	A	56	VAL	3.0
1	B	336	LEU	2.9
1	B	296	ILE	2.9
1	B	342	LEU	2.8
1	A	70	LEU	2.8
1	B	70	LEU	2.8
1	A	241	LEU	2.8
1	A	296	ILE	2.7
1	A	342	LEU	2.7
1	B	64	VAL	2.6
1	B	279	PHE	2.6
1	A	239	LEU	2.6
1	B	241	LEU	2.6
1	A	74	ILE	2.6
1	A	64	VAL	2.5
1	B	303	ALA	2.4
1	B	377	ARG	2.4
1	A	351	THR	2.4

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Mol	Chain	Res	Type	RSRZ
1	B	203	TYR	2.4
1	A	350	TYR	2.3
1	B	239	LEU	2.3
1	B	264	LEU	2.3
1	B	74	ILE	2.3
1	B	237	LEU	2.3
1	B	308	ALA	2.3
1	B	204	ALA	2.3
1	A	52	VAL	2.3
1	A	87	TYR	2.3
1	A	249	LEU	2.3
1	A	237	LEU	2.2
1	A	295	LEU	2.2
1	B	292	LEU	2.2
1	B	195	LYS	2.2
1	B	310	ALA	2.2
1	B	259	PHE	2.2
1	A	192	LYS	2.2
1	A	424	LEU	2.1
1	B	311	LEU	2.1
1	A	265	ILE	2.1
1	A	336	LEU	2.1
1	A	81	LEU	2.1
1	B	41	LEU	2.1
1	B	340	ARG	2.1
1	A	429	GLY	2.1
1	B	46	LEU	2.0
1	B	266	VAL	2.0
1	B	208	ILE	2.0
1	B	295	LEU	2.0
1	B	420	LEU	2.0
1	B	283	PRO	2.0
1	A	43	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 monosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.