



Full wwPDB X-ray Structure Validation Report ⓘ

May 20, 2026 – 08:11 PM EDT

PDB ID : 12FE / pdb_000012fe
Title : Crystal structure of unliganded Fab 399
Authors : Jain, M.; Wilson, I.A.
Deposited on : 2026-04-01
Resolution : 2.29 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	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

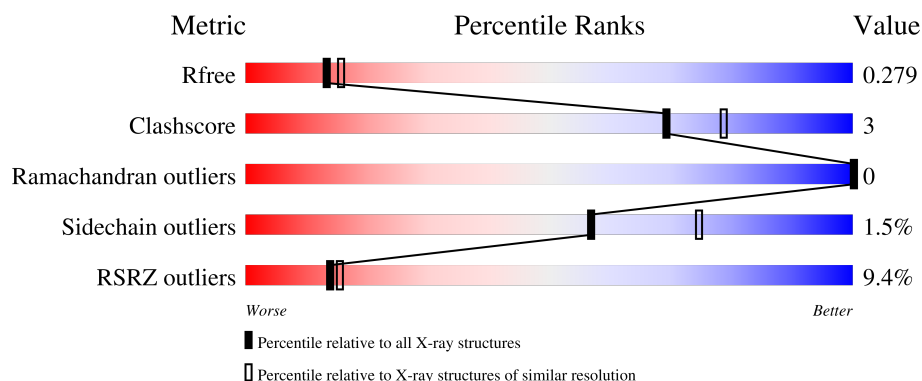
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.29 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}	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	B	219	<div> <div>5%</div> <div>95%</div> <div>.</div> </div>
1	L	219	<div> <div>5%</div> <div>86%</div> <div>13%</div> </div>
2	A	224	<div> <div>14%</div> <div>83%</div> <div>12%</div> <div>.</div> </div>
2	C	224	<div> <div>12%</div> <div>87%</div> <div>9%</div> <div>.</div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6730 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 Light Chain of Fab 399.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	L	218	Total	C	N	O	S	0	1	0
			1688	1063	281	338	6			
1	B	218	Total	C	N	O	S	0	1	0
			1688	1063	281	338	6			

- Molecule 2 is a protein called Heavy Chain of Fab 399.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	214	Total	C	N	O	S	0	0	0
			1603	1023	267	307	6			
2	C	216	Total	C	N	O	S	0	0	0
			1604	1022	267	309	6			

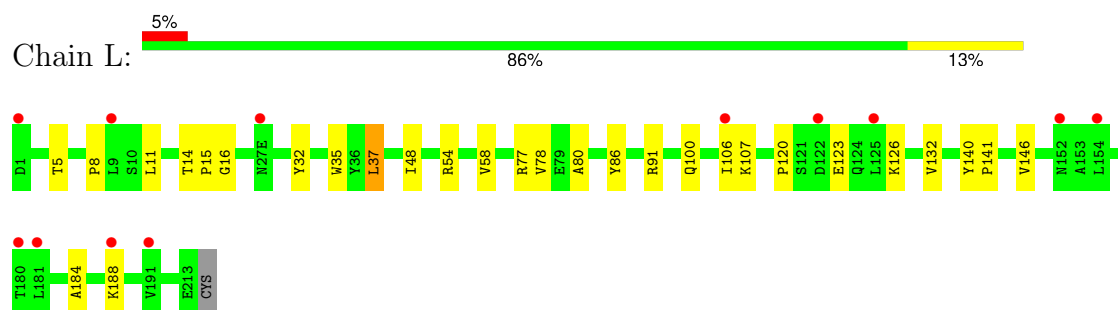
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	L	41	Total	O	0	0
			41	41		
3	A	30	Total	O	0	0
			30	30		
3	C	33	Total	O	0	0
			33	33		
3	B	43	Total	O	0	0
			43	43		

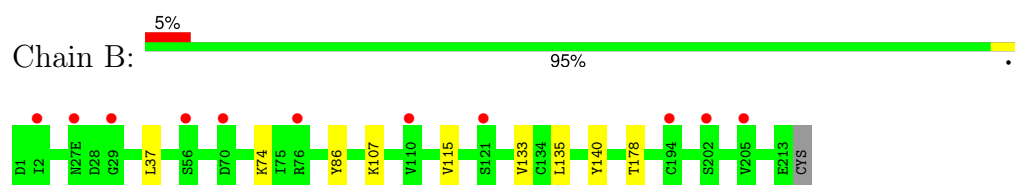
3 Residue-property plots [i](#)

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.

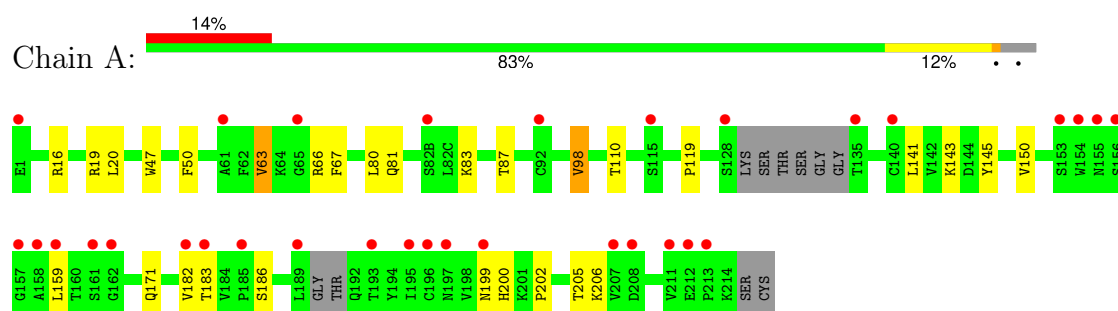
- Molecule 1: Light Chain of Fab 399



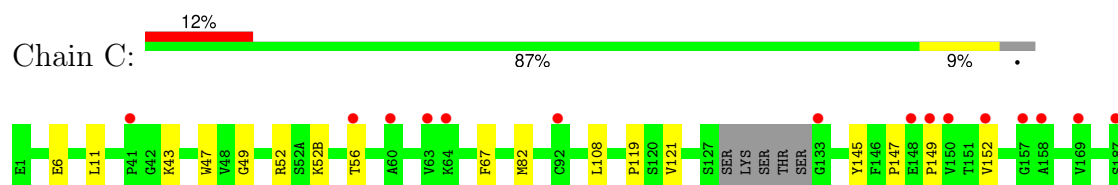
- Molecule 1: Light Chain of Fab 399

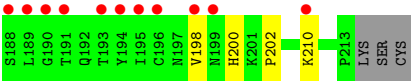


- Molecule 2: Heavy Chain of Fab 399



- Molecule 2: Heavy Chain of Fab 399





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	63.90Å 86.93Å 89.77Å 90.00° 100.85° 90.00°	Depositor
Resolution (Å)	39.32 – 2.29 39.32 – 2.29	Depositor EDS
% Data completeness (in resolution range)	96.1 (39.32-2.29) 95.8 (39.32-2.29)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	9.07 (at 2.29Å)	Xtriage
Refinement program	PHENIX (1.21.2_5419: ???)	Depositor
R, R_{free}	0.242 , 0.280 0.242 , 0.279	Depositor DCC
R_{free} test set	2000 reflections (4.80%)	wwPDB-VP
Wilson B-factor (Å ²)	32.5	Xtriage
Anisotropy	0.250	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 25.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	6730	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.56% 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 [i](#)

5.1 Standard geometry [i](#)

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	B	0.09	0/1725	0.27	0/2345
1	L	0.13	0/1725	0.34	0/2345
2	A	0.13	0/1641	0.31	0/2232
2	C	0.08	0/1643	0.26	0/2238
All	All	0.11	0/6734	0.30	0/9160

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 [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	B	1688	0	1629	5	0
1	L	1688	0	1629	16	0
2	A	1603	0	1583	15	0
2	C	1604	0	1573	10	0
3	A	30	0	0	0	0
3	B	43	0	0	0	0
3	C	33	0	0	0	0
3	L	41	0	0	0	0
All	All	6730	0	6414	45	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 3.

All (45) 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:C:11:LEU:HB2	2:C:147:PRO:HG3	1.77	0.67
2:C:121:VAL:HG21	2:C:198:VAL:HG11	1.77	0.66
2:A:119:PRO:HB3	2:A:145:TYR:HB3	1.78	0.64
1:L:32:TYR:HD1	1:L:91:ARG:HD3	1.66	0.60
1:L:78:VAL:HG12	1:L:106:ILE:HD11	1.84	0.60
2:C:52:ARG:HH11	2:C:56:THR:HG23	1.68	0.58
2:C:119:PRO:HB3	2:C:145:TYR:HB3	1.86	0.58
2:A:87:THR:HG23	2:A:110:THR:HA	1.86	0.57
1:L:8:PRO:HD2	1:L:11:LEU:HD11	1.87	0.56
2:A:141:LEU:HG	2:A:143:LYS:HG3	1.90	0.52
2:A:98:VAL:HG12	2:C:52(B):LYS:HB2	1.92	0.51
1:L:54:ARG:HG2	1:L:58:VAL:HB	1.94	0.49
1:L:120:PRO:HD3	1:L:132:VAL:HG22	1.93	0.49
1:L:184:ALA:O	1:L:188:LYS:HG3	2.11	0.49
2:C:200:HIS:CD2	2:C:202:PRO:HD2	2.48	0.49
1:B:133:VAL:HG22	1:B:178:THR:HG22	1.94	0.49
2:A:47:TRP:HZ2	2:A:50:PHE:HD1	1.61	0.48
2:A:200:HIS:CD2	2:A:202:PRO:HD2	2.48	0.48
1:L:15:PRO:HD3	1:L:107:LYS:O	2.14	0.48
1:L:100:GLN:H	1:L:100:GLN:NE2	2.12	0.48
2:C:108:LEU:HD23	2:C:149:PRO:HD3	1.96	0.48
1:L:16:GLY:HA2	1:L:77:ARG:HG3	1.96	0.47
2:C:47:TRP:CZ2	2:C:49:GLY:HA2	2.50	0.47
1:L:37:LEU:HG	1:L:86:TYR:CE2	2.49	0.47
2:A:20:LEU:HD12	2:A:80:LEU:HD23	1.97	0.46
1:L:80:ALA:HA	1:L:106:ILE:HG13	1.97	0.46
1:L:123:GLU:O	1:L:126:LYS:N	2.47	0.46
1:L:35:TRP:HB2	1:L:48:ILE:HB	1.97	0.46
2:A:19:ARG:HG3	2:A:81:GLN:HG2	1.97	0.46
2:A:16:ARG:HD3	2:A:16:ARG:HA	1.73	0.45
1:B:107:LYS:HA	1:B:140:TYR:OH	2.17	0.44
2:A:19:ARG:HB2	2:A:81:GLN:NE2	2.32	0.44
2:A:63:VAL:HG23	2:A:67:PHE:H	1.84	0.43
1:B:37:LEU:HD13	1:B:86:TYR:CZ	2.53	0.43
2:C:43:LYS:HB3	2:C:43:LYS:HE2	1.74	0.43
1:L:5:THR:HA	1:L:100:GLN:HE22	1.83	0.42
1:B:74:LYS:HE3	1:B:74:LYS:HB3	1.88	0.42
2:A:199:ASN:HB2	2:A:206:LYS:HE3	2.01	0.42
1:B:115:VAL:HA	1:B:135:LEU:O	2.19	0.42
2:A:159:LEU:HD21	2:A:182:VAL:HG11	2.01	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:119:PRO:HD2	2:A:205:THR:HG21	2.01	0.41
2:C:67:PHE:CE2	2:C:82:MET:HG2	2.55	0.41
2:A:66:ARG:HD3	2:A:83:LYS:NZ	2.36	0.41
1:L:14:THR:HA	1:L:107:LYS:HB2	2.01	0.41
1:L:140:TYR:CG	1:L:141:PRO:HA	2.56	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	B	217/219 (99%)	213 (98%)	4 (2%)	0	100	100
1	L	217/219 (99%)	212 (98%)	5 (2%)	0	100	100
2	A	208/224 (93%)	204 (98%)	4 (2%)	0	100	100
2	C	212/224 (95%)	209 (99%)	3 (1%)	0	100	100
All	All	854/886 (96%)	838 (98%)	16 (2%)	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	B	190/196 (97%)	190 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	L	190/196 (97%)	188 (99%)	2 (1%)	65	81
2	A	177/185 (96%)	171 (97%)	6 (3%)	32	49
2	C	175/185 (95%)	172 (98%)	3 (2%)	53	72
All	All	732/762 (96%)	721 (98%)	11 (2%)	57	75

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	L	37	LEU
1	L	146	VAL
2	A	63	VAL
2	A	98	VAL
2	A	150	VAL
2	A	171	GLN
2	A	183	THR
2	A	186	SER
2	C	6	GLU
2	C	152	VAL
2	C	210	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	L	38	GLN
1	L	42	GLN
1	L	100	GLN
1	L	137	ASN
2	A	81	GLN
2	C	39	GLN
1	B	53	ASN
1	B	137	ASN
1	B	160	GLN
1	B	189	HIS

5.3.3 RNA ⓘ

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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	B	218/219 (99%)	0.69	11 (5%) 34 35	21, 33, 55, 67	1 (0%)
1	L	218/219 (99%)	0.63	12 (5%) 30 32	16, 32, 48, 65	1 (0%)
2	A	214/224 (95%)	1.13	32 (14%) 5 6	22, 40, 68, 76	0
2	C	216/224 (96%)	1.00	26 (12%) 9 9	18, 37, 63, 84	0
All	All	866/886 (97%)	0.86	81 (9%) 14 15	16, 35, 62, 84	2 (0%)

All (81) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	L	152	ASN	4.4
2	C	63	VAL	4.4
2	C	190	GLY	4.3
2	A	128	SER	4.1
2	C	150	VAL	4.1
2	A	185	PRO	3.8
2	C	60	ALA	3.7
2	C	199	ASN	3.7
2	A	183	THR	3.6
2	C	193	THR	3.5
2	C	189	LEU	3.5
2	C	133	GLY	3.4
2	A	158	ALA	3.4
2	C	198	VAL	3.4
2	A	140	CYS	3.4
2	C	195	ILE	3.3
1	L	1	ASP	3.2
2	A	155	ASN	3.2
1	L	154	LEU	3.2
2	A	161	SER	3.2
2	C	194	TYR	3.1

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Mol	Chain	Res	Type	RSRZ
2	A	197	ASN	2.9
2	C	196	CYS	2.9
2	A	154	TRP	2.9
1	L	9	LEU	2.8
2	A	212	GLU	2.8
1	L	122	ASP	2.8
2	C	188	SER	2.8
2	C	64	LYS	2.8
2	A	135	THR	2.7
2	A	82(B)	SER	2.7
2	A	159	LEU	2.7
2	C	187	SER	2.7
2	C	191	THR	2.7
2	A	207	VAL	2.7
1	B	27(E)	ASN	2.6
2	A	65	GLY	2.6
2	A	162	GLY	2.6
1	B	76	ARG	2.6
2	A	157	GLY	2.6
1	B	121	SER	2.6
1	L	180	THR	2.5
1	L	181	LEU	2.5
2	C	56	THR	2.5
1	B	110	VAL	2.5
2	A	196	CYS	2.5
2	C	158	ALA	2.4
2	A	195	ILE	2.4
2	A	199	ASN	2.4
1	B	2	ILE	2.4
1	B	194	CYS	2.4
1	B	202	SER	2.3
2	A	115	SER	2.3
2	A	189	LEU	2.3
2	A	1	GLU	2.3
2	A	193	THR	2.3
2	A	182	VAL	2.3
1	B	70	ASP	2.3
1	L	106	ILE	2.3
1	L	125	LEU	2.2
2	C	41	PRO	2.2
2	C	148	GLU	2.2
2	C	149	PRO	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	29	GLY	2.2
2	C	157	GLY	2.2
1	L	188	LYS	2.2
2	A	211	VAL	2.2
2	C	152	VAL	2.2
2	C	92	CYS	2.1
2	A	92	CYS	2.1
1	L	191	VAL	2.1
1	B	56	SER	2.1
2	A	153	SER	2.1
2	A	61	ALA	2.1
2	A	213	PRO	2.1
1	B	205	VAL	2.1
2	A	156	SER	2.0
2	A	208	ASP	2.0
2	C	169	VAL	2.0
2	C	210	LYS	2.0
1	L	27(E)	ASN	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 oligosaccharides 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.