Full wwPDB X-ray Structure Validation Report (i)

Oct 24, 2023 – 09:04 PM EDT

PDB ID	:	2ZZF
Title	:	Crystal structure of alanyl-tRNA synthetase without oligomerization domain
Authors	:	Sokabe, M.; Ose, T.; Tokunaga, K.; Nakamura, A.; Nureki, O.; Yao, M.; Tanaka, I.
Deposited on	:	2009-02-10
Resolution	:	2.70 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 (i) 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 (1)) were used in the production of this report:

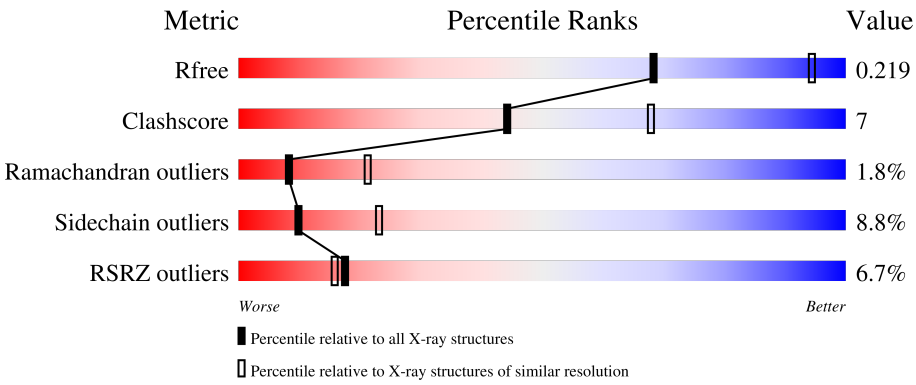
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

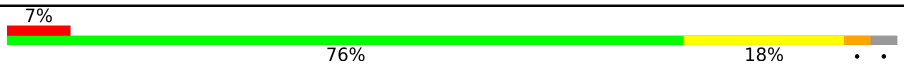
The reported resolution of this entry is 2.70 Å.

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	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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	752	

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 5942 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 Alanyl-tRNA synthetase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	728	5926	3822	1011	1063	30	0	0	0

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
2	A	2	2	2	0	0

- Molecule 3 is water.

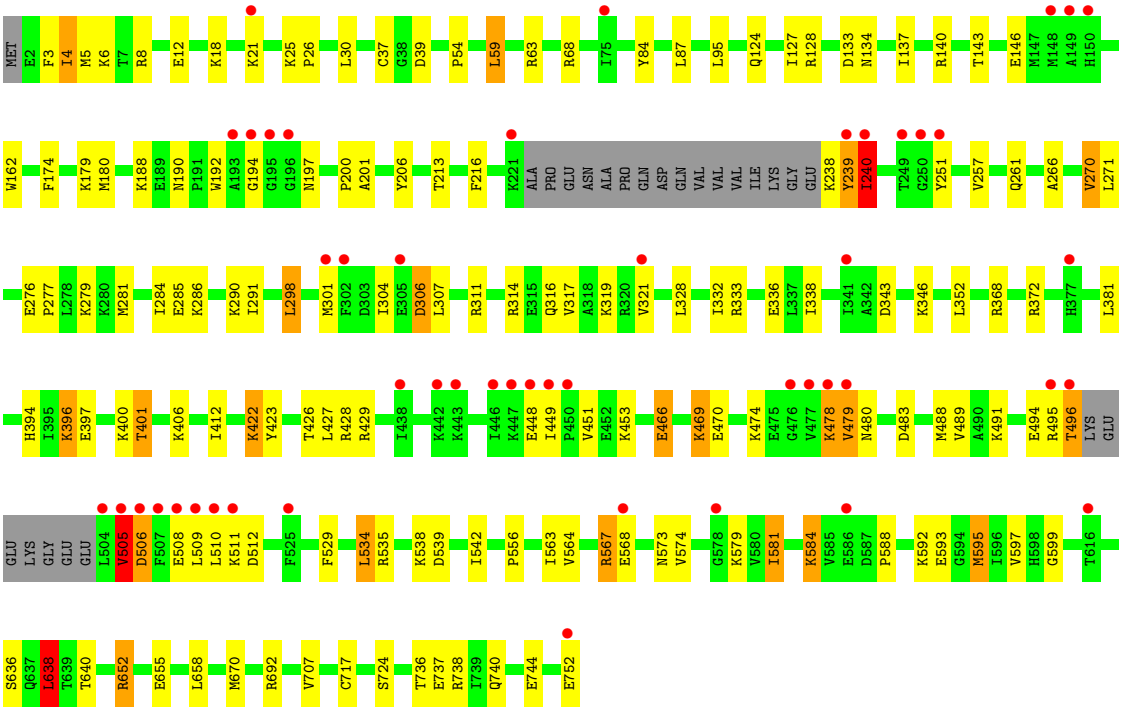
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	14	14	14	0	0

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: Alanyl-tRNA synthetase

Chain A:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	164.26Å 98.84Å 72.93Å 90.00° 108.64° 90.00°	Depositor
Resolution (Å)	30.15 – 2.70 30.15 – 2.70	Depositor EDS
% Data completeness (in resolution range)	98.5 (30.15-2.70) 98.5 (30.15-2.70)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.83 (at 2.72Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.206 , 0.263 0.222 , 0.219	Depositor DCC
R_{free} test set	1503 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	74.9	Xtriage
Anisotropy	0.206	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 42.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	5942	wwPDB-VP
Average B, all atoms (Å^2)	75.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.17% 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 (i)

5.1 Standard geometry (i)

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

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	0.61	0/6065	0.71	3/8185 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	638	LEU	CA-CB-CG	7.22	131.90	115.30
1	A	692	ARG	NE-CZ-NH2	-5.95	117.32	120.30
1	A	368	ARG	NE-CZ-NH2	-5.08	117.76	120.30

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	A	5926	0	5994	79	0
2	A	2	0	0	0	0
3	A	14	0	0	1	0
All	All	5942	0	5994	79	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 7.

All (79) 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:4:ILE:HG23	1:A:5:MET:H	1.20	1.01
1:A:469:LYS:HB2	1:A:479:VAL:HB	1.54	0.89
1:A:84:TYR:H	1:A:124:GLN:HE22	1.31	0.77
1:A:134:ASN:HD21	1:A:304:ILE:HB	1.50	0.74
1:A:574:VAL:HG13	1:A:581:ILE:HD12	1.71	0.73
1:A:574:VAL:CG1	1:A:581:ILE:HD12	2.20	0.72
1:A:239:TYR:O	1:A:240:ILE:HB	1.87	0.72
1:A:277:PRO:O	1:A:281:MET:HG3	1.89	0.71
1:A:4:ILE:HG23	1:A:5:MET:N	2.03	0.67
1:A:4:ILE:CG2	1:A:5:MET:H	1.99	0.66
1:A:574:VAL:CG1	1:A:581:ILE:CD1	2.75	0.65
1:A:59:LEU:HD22	1:A:257:VAL:HG21	1.79	0.64
1:A:372:ARG:HH21	1:A:422:LYS:HZ1	1.46	0.63
1:A:134:ASN:ND2	1:A:304:ILE:HD12	2.13	0.63
1:A:574:VAL:HG13	1:A:581:ILE:CD1	2.29	0.63
1:A:478:LYS:HA	1:A:478:LYS:HE2	1.81	0.62
1:A:4:ILE:HD11	1:A:6:LYS:NZ	2.14	0.62
1:A:397:GLU:O	1:A:400:LYS:HE3	2.01	0.60
1:A:328:LEU:O	1:A:332:ILE:HG13	2.02	0.59
1:A:3:PHE:CZ	1:A:200:PRO:HD3	2.38	0.58
1:A:505:VAL:O	1:A:506:ASP:HB2	2.02	0.58
1:A:291:ILE:HG12	1:A:321:VAL:HG11	1.84	0.58
1:A:304:ILE:C	1:A:306:ASP:H	2.08	0.56
1:A:174:PHE:O	1:A:180:MET:HG3	2.05	0.56
1:A:192:TRP:CH2	1:A:194:GLY:HA3	2.41	0.56
1:A:512:ASP:OD2	1:A:535:ARG:NH1	2.38	0.55
1:A:63:ARG:NE	1:A:146:GLU:OE1	2.34	0.55
1:A:266:ALA:O	1:A:270:VAL:HG13	2.07	0.54
1:A:59:LEU:HD21	1:A:270:VAL:HB	1.90	0.54
1:A:564:VAL:HB	1:A:597:VAL:HG12	1.90	0.53
1:A:4:ILE:HD11	1:A:6:LYS:HZ2	1.73	0.53
1:A:134:ASN:HD21	1:A:304:ILE:CB	2.22	0.51
1:A:573:ASN:HB3	1:A:584:LYS:HB3	1.93	0.51
1:A:8:ARG:O	1:A:12:GLU:HG3	2.10	0.51
1:A:508:GLU:C	1:A:510:LEU:H	2.15	0.51
1:A:707:VAL:HG23	1:A:717:CYS:HB3	1.93	0.50
1:A:37:CYS:SG	1:A:39:ASP:HB3	2.52	0.49
1:A:529:PHE:CE1	1:A:599:GLY:HA3	2.47	0.49
1:A:563:ILE:HG12	1:A:568:GLU:HG2	1.95	0.48
1:A:466:GLU:HG2	3:A:768:HOH:O	2.13	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:396:LYS:HB3	1:A:396:LYS:NZ	2.29	0.48
1:A:127:ILE:HG23	1:A:143:THR:HG22	1.96	0.48
1:A:652:ARG:HG2	1:A:738:ARG:HH21	1.79	0.47
1:A:238:LYS:HG2	1:A:239:TYR:H	1.79	0.47
1:A:512:ASP:OD1	1:A:512:ASP:N	2.40	0.47
1:A:270:VAL:HG22	1:A:271:LEU:HG	1.97	0.47
1:A:400:LYS:HG3	1:A:401:THR:HG22	1.97	0.46
1:A:592:LYS:O	1:A:595:MET:HB2	2.15	0.46
1:A:298:LEU:HD22	1:A:316:GLN:HG2	1.97	0.46
1:A:652:ARG:HH22	1:A:736:THR:HG23	1.80	0.45
1:A:564:VAL:O	1:A:567:ARG:HB2	2.16	0.45
1:A:352:LEU:HD12	1:A:412:ILE:HG23	1.97	0.45
1:A:162:TRP:CH2	1:A:216:PHE:HB3	2.52	0.44
1:A:535:ARG:HB3	1:A:542:ILE:HD12	2.00	0.44
1:A:180:MET:HB3	1:A:206:TYR:CZ	2.52	0.44
1:A:276:GLU:HB2	1:A:277:PRO:HD3	2.00	0.44
1:A:491:LYS:O	1:A:494:GLU:HG2	2.18	0.43
1:A:319:LYS:HB2	1:A:319:LYS:HE3	1.78	0.43
1:A:162:TRP:HA	1:A:162:TRP:CE3	2.53	0.43
1:A:290:LYS:HD3	1:A:321:VAL:HG13	2.01	0.43
1:A:314:ARG:NH1	1:A:336:GLU:OE2	2.48	0.43
1:A:495:ARG:HG3	1:A:496:THR:N	2.34	0.42
1:A:534:LEU:O	1:A:593:GLU:HG3	2.19	0.42
1:A:279:LYS:HG2	1:A:284:ILE:HD11	2.01	0.42
1:A:306:ASP:O	1:A:307:LEU:C	2.58	0.42
1:A:488:MET:HB3	1:A:489:VAL:H	1.65	0.42
1:A:18:LYS:O	1:A:26:PRO:HA	2.20	0.42
1:A:332:ILE:HD12	1:A:333:ARG:N	2.35	0.42
1:A:707:VAL:CG2	1:A:717:CYS:HB3	2.51	0.41
1:A:539:ASP:HA	1:A:588:PRO:HB3	2.02	0.41
1:A:372:ARG:HG2	1:A:423:TYR:CE2	2.56	0.41
1:A:190:ASN:O	1:A:201:ALA:HB3	2.21	0.41
1:A:338:ILE:HG13	1:A:381:LEU:HD11	2.03	0.41
1:A:738:ARG:NH1	1:A:744:GLU:OE2	2.54	0.41
1:A:25:LYS:HD3	1:A:188:LYS:HE2	2.02	0.41
1:A:54:PRO:HG3	1:A:179:LYS:HB2	2.03	0.41
1:A:133:ASP:O	1:A:137:ILE:HD12	2.21	0.41
1:A:346:LYS:HB2	1:A:394:HIS:CE1	2.57	0.40
1:A:556:PRO:HD3	1:A:638:LEU:HD22	2.04	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	722/752 (96%)	672 (93%)	37 (5%)	13 (2%)	8 21

All (13) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	240	ILE
1	A	474	LYS
1	A	4	ILE
1	A	505	VAL
1	A	506	ASP
1	A	239	TYR
1	A	301	MET
1	A	426	THR
1	A	511	LYS
1	A	306	ASP
1	A	449	ILE
1	A	538	LYS
1	A	451	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	635/655 (97%)	579 (91%)	56 (9%)	10 23

All (56) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	LYS
1	A	30	LEU
1	A	59	LEU
1	A	68	ARG
1	A	87	LEU
1	A	95	LEU
1	A	128	ARG
1	A	140	ARG
1	A	197	ASN
1	A	213	THR
1	A	240	ILE
1	A	251	TYR
1	A	261	GLN
1	A	270	VAL
1	A	285	GLU
1	A	286	LYS
1	A	298	LEU
1	A	311	ARG
1	A	317	VAL
1	A	343	ASP
1	A	396	LYS
1	A	401	THR
1	A	406	LYS
1	A	422	LYS
1	A	427	LEU
1	A	428	ARG
1	A	429	ARG
1	A	448	GLU
1	A	453	LYS
1	A	466	GLU
1	A	469	LYS
1	A	470	GLU
1	A	478	LYS
1	A	479	VAL
1	A	480	ASN
1	A	483	ASP
1	A	496	THR
1	A	505	VAL
1	A	509	LEU
1	A	534	LEU
1	A	567	ARG
1	A	579	LYS
1	A	581	ILE

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Mol	Chain	Res	Type
1	A	584	LYS
1	A	595	MET
1	A	636	SER
1	A	638	LEU
1	A	640	THR
1	A	652	ARG
1	A	655	GLU
1	A	658	LEU
1	A	670	MET
1	A	724	SER
1	A	737	GLU
1	A	740	GLN
1	A	752	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	124	GLN
1	A	134	ASN
1	A	218	GLN
1	A	261	GLN
1	A	565	ASN
1	A	608	GLN

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 2 ligands modelled in this entry, 2 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 (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	A	728/752 (96%)	0.40	49 (6%) 17 16	58, 74, 96, 129	0

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	506	ASP	5.3
1	A	496	THR	5.2
1	A	507	PHE	4.8
1	A	509	LEU	4.7
1	A	476	GLY	4.4
1	A	495	ARG	4.3
1	A	449	ILE	4.2
1	A	301	MET	4.1
1	A	752	GLU	4.0
1	A	305	GLU	4.0
1	A	510	LEU	3.9
1	A	477	VAL	3.8
1	A	511	LYS	3.8
1	A	505	VAL	3.6
1	A	447	LYS	3.6
1	A	508	GLU	3.6
1	A	504	LEU	3.5
1	A	448	GLU	3.2
1	A	194	GLY	3.2
1	A	479	VAL	3.2
1	A	478	LYS	3.2
1	A	442	LYS	3.0
1	A	195	GLY	3.0
1	A	240	ILE	2.9
1	A	450	PRO	2.9
1	A	438	ILE	2.9
1	A	443	LYS	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	149	ALA	2.9
1	A	21	LYS	2.8
1	A	193	ALA	2.7
1	A	148	MET	2.7
1	A	239	TYR	2.6
1	A	446	ILE	2.5
1	A	578	GLY	2.5
1	A	249	THR	2.4
1	A	568	GLU	2.4
1	A	250	GLY	2.4
1	A	251	TYR	2.4
1	A	377	HIS	2.3
1	A	302	PHE	2.3
1	A	150	HIS	2.2
1	A	321	VAL	2.2
1	A	196	GLY	2.2
1	A	341	ILE	2.1
1	A	221	LYS	2.1
1	A	586	GLU	2.1
1	A	75	ILE	2.1
1	A	525	PHE	2.0
1	A	616	THR	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	ZN	A	753	1/1	0.93	0.16	89,89,89,89	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	ZN	A	754	1/1	0.99	0.12	69,69,69,69	0

6.5 Other polymers (i)

There are no such residues in this entry.