



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 13, 2017 – 08:16 pm GMT

PDB ID : 2ZEL  
Title : Crystal structure of the human glutaminyl cyclase mutant D248A at 1.97 angstrom resolution  
Authors : Huang, K.F.; Wang, Y.R.; Chang, E.C.; Chou, T.L.; Wang, A.H.  
Deposited on : 2007-12-13  
Resolution : 1.97 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

<http://wwpdb.org/validation/2016/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 : 1.7.2 (RC1), CSD as538be (2017)  
Xtriage (Phenix) : 1.9-1692  
EDS : trunk28620  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
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) : recalc28949

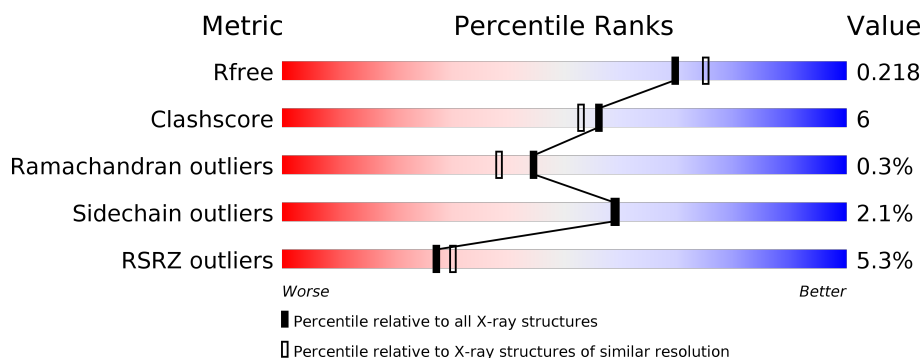
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.97 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))
$R_{free}$	100719	9293 (2.00-1.96)
Clashscore	112137	10621 (2.00-1.96)
Ramachandran outliers	110173	10502 (2.00-1.96)
Sidechain outliers	110143	10501 (2.00-1.96)
RSRZ outliers	101464	9395 (2.00-1.96)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	A	329	<div> <div>4%</div> <div>88%</div> <div>9%</div> <div>••</div> </div>
1	B	329	<div> <div>7%</div> <div>85%</div> <div>12%</div> <div>••</div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5914 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 Glutaminyl-peptide cyclotransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	323	Total	C	N	O	S	5	0	0
			2607	1672	450	476	9			
1	B	321	Total	C	N	O	S	5	0	0
			2599	1668	448	474	9			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	248	ALA	ASP	ENGINEERED	UNP Q16769
B	248	ALA	ASP	ENGINEERED	UNP Q16769

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Zn	0	0
			1	1		
2	A	1	Total	Zn	0	0
			1	1		

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



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

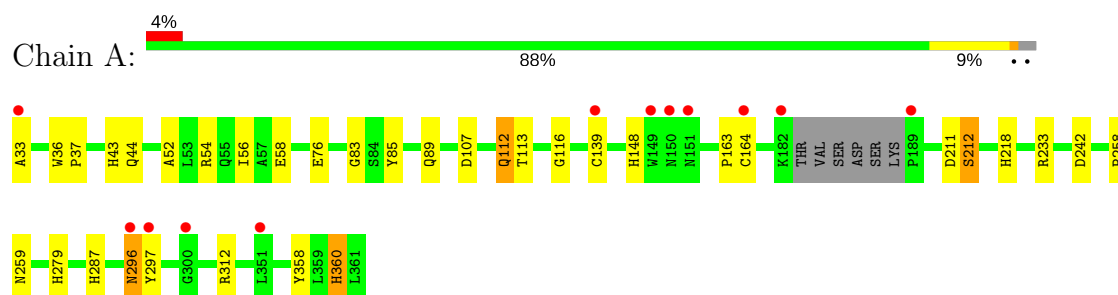
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	401	Total	O	0	0
			401	401		
4	B	295	Total	O	0	0
			295	295		

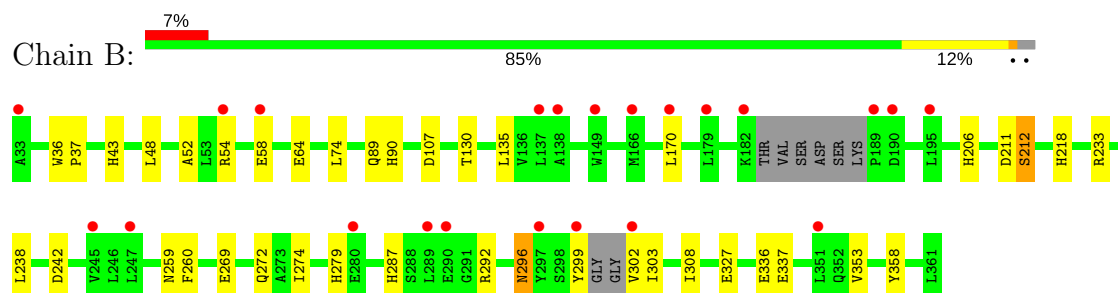
### 3 Residue-property plots [i](#)

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: Glutaminyl-peptide cyclotransferase



- Molecule 1: Glutaminyl-peptide cyclotransferase



## 4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	119.11Å 119.11Å 332.35Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 1.97 29.00 – 1.97	Depositor EDS
% Data completeness (in resolution range)	92.6 (30.00-1.97) 92.8 (29.00-1.97)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	0.06	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	5.44 (at 1.96Å)	Xtriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.176 , 0.218 0.177 , 0.218	Depositor DCC
$R_{free}$ test set	3015 reflections (5.05%)	DCC
Wilson B-factor (Å <sup>2</sup> )	30.8	Xtriage
Anisotropy	0.075	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.39 , 61.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5914	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.34% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, 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	A	0.85	0/2684	0.82	0/3652
1	B	0.77	0/2675	0.76	1/3639 (0.0%)
All	All	0.81	0/5359	0.79	1/7291 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	135	LEU	N-CA-C	-5.06	97.33	111.00

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	2607	0	2530	28	1
1	B	2599	0	2523	30	1
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	5	0	0	1	0
3	B	5	0	0	0	0
4	A	401	0	0	6	0
4	B	295	0	0	9	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	5914	0	5053	59	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 6.

All (59) 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:B:54:ARG:O	1:B:58:GLU:HG2	1.62	0.97
1:A:58:GLU:HG3	4:A:955:HOH:O	1.62	0.97
1:B:296:ASN:H	1:B:296:ASN:ND2	1.65	0.94
1:B:296:ASN:HD22	1:B:296:ASN:H	1.30	0.79
1:A:312:ARG:HD3	4:A:1093:HOH:O	1.81	0.79
1:A:218:HIS:HD2	4:A:590:HOH:O	1.69	0.75
1:B:292:ARG:HH21	1:B:296:ASN:HD21	1.34	0.75
1:B:90:HIS:HD2	4:B:449:HOH:O	1.70	0.74
1:B:296:ASN:N	1:B:296:ASN:HD22	1.82	0.73
1:A:312:ARG:HG2	1:A:312:ARG:HH11	1.56	0.70
1:B:218:HIS:HD2	4:B:621:HOH:O	1.74	0.69
1:B:89:GLN:HG2	4:B:962:HOH:O	1.94	0.65
1:A:112:GLN:HE21	1:A:113:THR:H	1.45	0.62
1:B:64:GLU:HG3	4:B:820:HOH:O	1.99	0.62
1:B:327:GLU:HG3	4:B:459:HOH:O	2.00	0.62
1:A:43:HIS:HE1	1:A:358:TYR:O	1.82	0.61
1:B:43:HIS:HD2	4:B:638:HOH:O	1.84	0.59
1:B:43:HIS:HE1	1:B:358:TYR:O	1.87	0.57
1:A:43:HIS:HD2	4:A:421:HOH:O	1.86	0.57
1:B:296:ASN:N	1:B:296:ASN:ND2	2.35	0.56
1:B:48:LEU:HB3	1:B:52:ALA:HB3	1.87	0.56
1:A:76:GLU:OE1	1:A:148:HIS:HE1	1.89	0.55
1:A:279:HIS:HD2	1:A:287:HIS:ND1	2.06	0.54
1:A:44:GLN:O	1:A:360:HIS:HE1	1.91	0.53
1:B:107:ASP:OD1	1:B:218:HIS:HE1	1.91	0.53
1:B:269:GLU:HA	1:B:272:GLN:HE21	1.74	0.51
1:B:302:VAL:HG11	1:B:308:ILE:HD11	1.93	0.51
1:A:85:TYR:O	1:A:89:GLN:HG2	2.11	0.50
1:A:112:GLN:HE22	1:A:116:GLY:HA2	1.76	0.50
1:B:211:ASP:O	1:B:212:SER:HB3	2.12	0.50
1:A:312:ARG:HH11	1:A:312:ARG:CG	2.25	0.49
1:A:279:HIS:CD2	1:A:287:HIS:ND1	2.81	0.49
1:B:292:ARG:NH2	1:B:296:ASN:HD21	2.07	0.48

*Continued on next page...*



Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:296:ASN:OD1	1:A:296:ASN:N	2.45	0.48
1:B:233:ARG:NH2	4:B:1050:HOH:O	2.46	0.47
1:A:211:ASP:O	1:A:212:SER:HB3	2.15	0.46
1:B:54:ARG:NH1	4:B:769:HOH:O	2.48	0.46
1:A:112:GLN:HA	1:A:112:GLN:HE21	1.81	0.46
1:B:260:PHE:CD2	1:B:299:TYR:HB3	2.51	0.46
1:A:107:ASP:OD1	1:A:218:HIS:HE1	1.99	0.46
1:A:54:ARG:HD3	4:A:942:HOH:O	2.14	0.46
1:A:36:TRP:CG	1:A:37:PRO:HD3	2.51	0.45
1:B:43:HIS:CE1	1:B:358:TYR:O	2.68	0.45
1:B:36:TRP:CG	1:B:37:PRO:HD3	2.52	0.45
1:A:233:ARG:HB2	1:A:233:ARG:HH11	1.82	0.45
1:A:139:CYS:HG	1:A:164:CYS:HG	1.64	0.44
1:B:274:ILE:HD13	1:B:353:VAL:HG12	1.99	0.44
1:A:258:PRO:HB3	1:A:297:TYR:CZ	2.53	0.43
1:A:112:GLN:HE21	1:A:113:THR:N	2.13	0.42
1:A:76:GLU:O	1:A:83:GLY:HA3	2.19	0.42
1:A:112:GLN:NE2	1:A:113:THR:H	2.16	0.42
1:A:43:HIS:CE1	1:A:358:TYR:O	2.69	0.42
3:A:395:SO4:O1	4:A:594:HOH:O	2.22	0.41
1:A:52:ALA:O	1:A:56:ILE:HG12	2.21	0.41
1:B:74:LEU:HD13	1:B:336:GLU:HB2	2.03	0.41
1:B:279:HIS:HD2	1:B:287:HIS:ND1	2.19	0.41
1:B:170:LEU:HD23	1:B:170:LEU:C	2.41	0.41
1:B:302:VAL:HG12	1:B:303:ILE:N	2.37	0.40
1:B:90:HIS:CD2	4:B:449:HOH:O	2.56	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:33:ALA:O	1:B:337:GLU:OE1[11 _ 445]	2.09	0.11

## 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	319/329 (97%)	310 (97%)	8 (2%)	1 (0%)	44	38
1	B	315/329 (96%)	306 (97%)	8 (2%)	1 (0%)	44	38
All	All	634/658 (96%)	616 (97%)	16 (2%)	2 (0%)	44	38

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	212	SER
1	B	212	SER

### 5.3.2 Protein sidechains ⓘ

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	283/289 (98%)	277 (98%)	6 (2%)	59	59
1	B	283/289 (98%)	277 (98%)	6 (2%)	59	59
All	All	566/578 (98%)	554 (98%)	12 (2%)	59	59

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	112	GLN
1	A	163	PRO
1	A	242	ASP
1	A	259	ASN
1	A	296	ASN
1	A	360	HIS
1	B	130	THR
1	B	206	HIS
1	B	238	LEU
1	B	242	ASP
1	B	259	ASN

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	B	296	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (21) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	43	HIS
1	A	93	GLN
1	A	112	GLN
1	A	128	ASN
1	A	148	HIS
1	A	150	ASN
1	A	218	HIS
1	A	259	ASN
1	A	272	GLN
1	A	279	HIS
1	A	338	ASN
1	A	360	HIS
1	B	43	HIS
1	B	128	ASN
1	B	148	HIS
1	B	218	HIS
1	B	259	ASN
1	B	272	GLN
1	B	279	HIS
1	B	296	ASN
1	B	338	ASN

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

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	395	-	4,4,4	0.25	0	6,6,6	0.38	0
3	SO4	B	396	-	4,4,4	0.65	0	6,6,6	0.27	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	395	-	-	0/0/0/0	0/0/0/0
3	SO4	B	396	-	-	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.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	395	SO4	1	0

## 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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	322/329 (97%)	-0.09	12 (3%) 42 45	23, 30, 44, 64	0
1	B	320/329 (97%)	0.22	22 (6%) 18 20	25, 37, 55, 81	0
All	All	642/658 (97%)	0.06	34 (5%) 27 30	23, 33, 53, 81	0

All (34) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	297	TYR	7.9
1	B	189	PRO	6.2
1	B	33	ALA	5.6
1	A	33	ALA	4.8
1	A	297	TYR	4.7
1	B	289	LEU	4.2
1	A	189	PRO	3.6
1	B	299	TYR	3.6
1	B	290	GLU	3.2
1	A	150	ASN	3.2
1	B	302	VAL	3.1
1	A	149	TRP	3.1
1	A	151	ASN	3.0
1	B	247	LEU	3.0
1	B	190	ASP	2.9
1	A	296	ASN	2.8
1	B	149	TRP	2.7
1	B	54	ARG	2.6
1	B	58	GLU	2.6
1	B	245	VAL	2.6
1	B	351	LEU	2.4
1	B	195	LEU	2.3
1	A	182	LYS	2.3
1	B	182	LYS	2.3

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	B	179	LEU	2.3
1	A	300	GLY	2.2
1	A	139	CYS	2.2
1	A	164	CYS	2.2
1	B	166	MET	2.2
1	B	138	ALA	2.1
1	B	137	LEU	2.1
1	B	170	LEU	2.1
1	A	351	LEU	2.0
1	B	280	GLU	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](#)

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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
3	SO4	B	396	5/5	0.96	0.09	-0.39	45,46,47,48	0
3	SO4	A	395	5/5	0.98	0.09	-0.73	46,46,48,48	0
2	ZN	B	392	1/1	1.00	0.06	-1.20	30,30,30,30	0
2	ZN	A	391	1/1	1.00	0.07	-4.06	27,27,27,27	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.