



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 12:26 AM GMT

PDB ID : 2AGS  
Title : Trypanosoma rangeli Sialidase in Complex with 2-Keto-3-deoxy-D-glycero-D-galacto-2,3-difluoro-nononic acid (2,3-difluoro-KDN)  
Authors : Amaya, M.F.; Alzari, P.M.; Buschiazzi, A.  
Deposited on : 2005-07-27  
Resolution : 1.70 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](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.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
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) : trunk26865

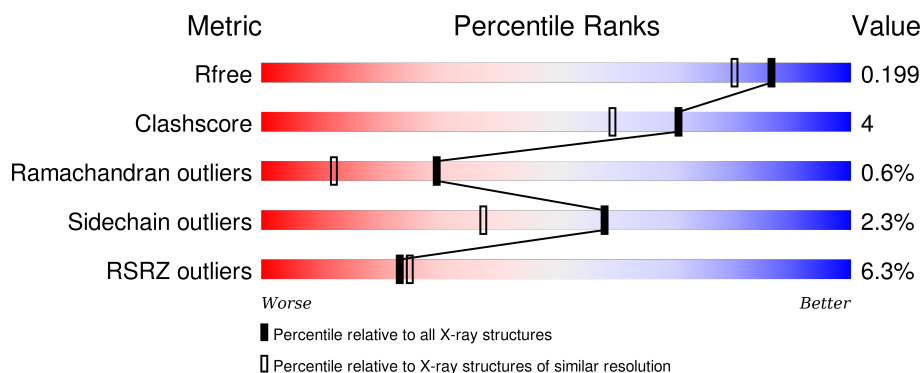
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*


The reported resolution of this entry is 1.70 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))
$R_{free}$	91344	3190 (1.70-1.70)
Clashscore	102246	3585 (1.70-1.70)
Ramachandran outliers	100387	3527 (1.70-1.70)
Sidechain outliers	100360	3527 (1.70-1.70)
RSRZ outliers	91569	3200 (1.70-1.70)

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 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	652	 6% 89% 7% ..

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5767 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 sialidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	634	4934	3110	871	935	18	0	5	0

There are 18 discrepancies between the modelled and reference sequences:

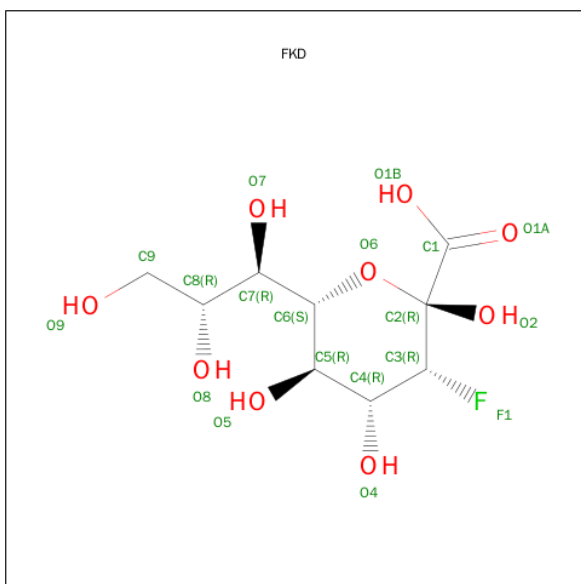
Chain	Residue	Modelled	Actual	Comment	Reference
A	-13	MET	-	CLONING ARTIFACT	UNP O44049
A	-12	GLY	-	CLONING ARTIFACT	UNP O44049
A	-11	GLY	-	CLONING ARTIFACT	UNP O44049
A	-10	SER	-	CLONING ARTIFACT	UNP O44049
A	-9	HIS	-	EXPRESSION TAG	UNP O44049
A	-8	HIS	-	EXPRESSION TAG	UNP O44049
A	-7	HIS	-	EXPRESSION TAG	UNP O44049
A	-6	HIS	-	EXPRESSION TAG	UNP O44049
A	-5	HIS	-	EXPRESSION TAG	UNP O44049
A	-4	HIS	-	EXPRESSION TAG	UNP O44049
A	-3	GLY	-	CLONING ARTIFACT	UNP O44049
A	-2	MET	-	CLONING ARTIFACT	UNP O44049
A	-1	ALA	-	CLONING ARTIFACT	UNP O44049
A	0	SER	-	CLONING ARTIFACT	UNP O44049
A	50	ILE	THR	SEE REMARK 999	UNP O44049
A	186	ALA	GLY	SEE REMARK 999	UNP O44049
A	372	LEU	PHE	SEE REMARK 999	UNP O44049
A	606	VAL	ILE	SEE REMARK 999	UNP O44049

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



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

- Molecule 3 is 2,6-ANHYDRO-3-DEOXY-3-FLUORO-L-ARABINO-D-GALACTO-NONONIC ACID (three-letter code: FKD) (formula: C<sub>9</sub>H<sub>15</sub>FO<sub>9</sub>).



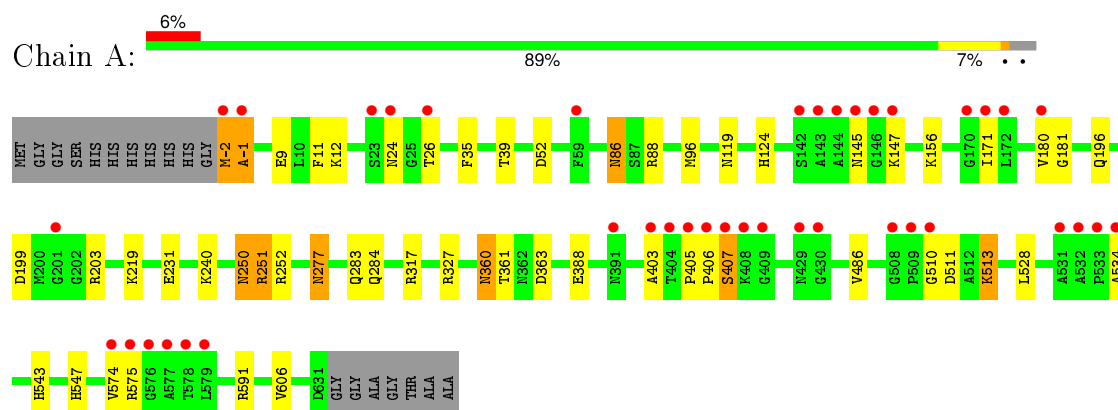
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	F	O	0	0
			18	9	1	8		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	805	Total 805	O 805	0	0



- Molecule 1: sialidase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	73.67Å 95.57Å 105.82Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.00 – 1.70 34.79 – 1.70	Depositor EDS
% Data completeness (in resolution range)	98.3 (35.00-1.70) 98.3 (34.79-1.70)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	0.07	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.36 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.154 , 0.189 0.168 , 0.199	Depositor DCC
$R_{free}$ test set	4074 reflections (5.28%)	DCC
Wilson B-factor (Å <sup>2</sup> )	12.9	Xtriage
Anisotropy	0.012	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 50.0	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 81306 reflections	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5767	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	16.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.25% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FKD, 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	0.81	0/5043	0.87	9/6850 (0.1%)

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	A	0	1

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	251	ARG	NE-CZ-NH2	10.35	125.47	120.30
1	A	251	ARG	NE-CZ-NH1	-10.16	115.22	120.30
1	A	52	ASP	CB-CG-OD1	6.45	124.11	118.30
1	A	317	ARG	NE-CZ-NH1	6.32	123.46	120.30
1	A	510	GLY	N-CA-C	-5.70	98.85	113.10
1	A	284	GLN	CA-CB-CG	5.48	125.45	113.40
1	A	199	ASP	CB-CG-OD1	5.33	123.10	118.30
1	A	52	ASP	CB-CG-OD2	-5.18	113.64	118.30
1	A	219	LYS	CD-CE-NZ	5.18	123.61	111.70

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	-2	MET	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	4934	0	4853	43	0
2	A	10	0	0	0	0
3	A	18	0	13	0	0
4	A	805	0	0	14	0
All	All	5767	0	4866	43	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 4.

All (43) 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:250:ASN:HD22	1:A:251:ARG:H	1.26	0.82
1:A:24:ASN:OD1	1:A:26:THR:HG22	1.84	0.77
1:A:360:ASN:HD21	1:A:363:ASP:H	1.40	0.69
1:A:543:HIS:HE1	4:A:1349:HOH:O	1.83	0.62
1:A:86:ASN:HD22	1:A:88:ARG:H	1.47	0.61
1:A:513:LYS:HE3	4:A:1456:HOH:O	2.00	0.60
1:A:250:ASN:ND2	1:A:251:ARG:H	1.97	0.59
1:A:96[C]:MET:HB2	4:A:1319:HOH:O	2.02	0.59
1:A:96[B]:MET:HB2	4:A:1319:HOH:O	2.04	0.58
1:A:388[B]:GLU:HG3	4:A:1358:HOH:O	2.02	0.58
1:A:360:ASN:C	1:A:360:ASN:HD22	2.06	0.58
1:A:405:PRO:O	1:A:407:SER:N	2.37	0.58
1:A:171:ILE:HD13	1:A:203:ARG:HH21	1.70	0.56
1:A:-2:MET:C	1:A:-1:ALA:O	2.46	0.53
1:A:360:ASN:HD21	1:A:363:ASP:N	2.07	0.53
1:A:511:ASP:O	1:A:513:LYS:HE2	2.09	0.52
1:A:543:HIS:HD2	4:A:1125:HOH:O	1.92	0.52
1:A:9:GLU:OE1	1:A:12[B]:LYS:HG3	2.09	0.52
1:A:250:ASN:HD22	1:A:251:ARG:N	2.02	0.50
1:A:360:ASN:HD22	1:A:361:THR:N	2.10	0.49
1:A:86:ASN:HD22	1:A:86:ASN:C	2.15	0.49
1:A:277:ASN:ND2	1:A:283:GLN:H	2.11	0.49
1:A:196:GLN:NE2	1:A:231:GLU:H	2.11	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:547:HIS:HE1	4:A:968:HOH:O	1.95	0.48
1:A:86:ASN:ND2	1:A:88:ARG:H	2.12	0.48
1:A:119:ASN:O	1:A:124:HIS:HE1	1.96	0.48
1:A:403:ALA:HB3	4:A:1698:HOH:O	2.13	0.47
1:A:86:ASN:HD21	1:A:88:ARG:HD3	1.80	0.46
1:A:171:ILE:CG2	4:A:1426:HOH:O	2.63	0.46
1:A:11:PHE:HB3	1:A:35:PHE:CG	2.51	0.46
1:A:534:ALA:C	4:A:1341:HOH:O	2.52	0.46
1:A:528:LEU:HD23	1:A:534:ALA:CB	2.45	0.45
1:A:534:ALA:HB1	4:A:1341:HOH:O	2.17	0.45
1:A:171:ILE:CD1	1:A:203:ARG:HH21	2.29	0.44
1:A:252:ARG:NH1	4:A:1516:HOH:O	2.51	0.44
1:A:360:ASN:C	1:A:360:ASN:ND2	2.71	0.43
1:A:528:LEU:HD23	1:A:534:ALA:HB1	2.02	0.42
1:A:486:VAL:O	1:A:606:VAL:HA	2.19	0.42
1:A:12[A]:LYS:NZ	4:A:1283:HOH:O	2.52	0.42
1:A:277:ASN:HD21	1:A:283:GLN:H	1.68	0.42
1:A:240:LYS:HD2	4:A:1442:HOH:O	2.21	0.41
1:A:39:THR:OG1	1:A:181:GLY:HA2	2.20	0.41
1:A:528:LEU:CD2	1:A:534:ALA:CB	2.99	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	638/652 (98%)	606 (95%)	28 (4%)	4 (1%)	30 12

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	-1	ALA

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Mol	Chain	Res	Type
1	A	406	PRO
1	A	180	VAL
1	A	407	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	533/540 (99%)	521 (98%)	12 (2%)	58	37

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

Mol	Chain	Res	Type
1	A	86	ASN
1	A	145	ASN
1	A	147	LYS
1	A	156	LYS
1	A	250	ASN
1	A	277	ASN
1	A	327	ARG
1	A	360	ASN
1	A	513	LYS
1	A	574	VAL
1	A	575	ARG
1	A	591	ARG

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

Mol	Chain	Res	Type
1	A	86	ASN
1	A	124	HIS
1	A	196	GLN
1	A	250	ASN
1	A	277	ASN
1	A	284	GLN

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Mol	Chain	Res	Type
1	A	360	ASN
1	A	543	HIS
1	A	547	HIS
1	A	605	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 [i](#)

3 ligands are modelled in this entry.

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	FKD	A	700	1	15,18,19	0.76	0	16,26,29	1.81	2 (12%)
2	SO4	A	901	-	4,4,4	0.61	0	6,6,6	0.57	0
2	SO4	A	902	-	4,4,4	0.20	0	6,6,6	0.11	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	FKD	A	700	1	-	0/10/34/39	0/1/1/1
2	SO4	A	901	-	-	0/0/0/0	0/0/0/0
2	SO4	A	902	-	-	0/0/0/0	0/0/0/0

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	700	FKD	O6-C6-C5	2.30	111.65	108.03
3	A	700	FKD	F1-C3-C2	6.15	115.67	108.17

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 ⓘ

### 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	634/652 (97%)	0.18	40 (6%)	23 25	7, 12, 29, 44	0

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	577	ALA	11.0
1	A	-2	MET	7.2
1	A	408	LYS	6.7
1	A	578	THR	6.6
1	A	405	PRO	6.3
1	A	145	ASN	6.3
1	A	406	PRO	6.0
1	A	144	ALA	5.8
1	A	-1	ALA	5.7
1	A	407	SER	5.7
1	A	575	ARG	5.6
1	A	534	ALA	5.5
1	A	404	THR	5.3
1	A	576	GLY	5.1
1	A	533	PRO	5.0
1	A	143	ALA	4.9
1	A	171	ILE	4.6
1	A	147	LYS	4.3
1	A	59[A]	PHE	4.2
1	A	532	ALA	4.1
1	A	146	GLY	3.9
1	A	170	GLY	3.5
1	A	26	THR	3.4
1	A	409	GLY	3.4
1	A	509	PRO	3.3
1	A	579	LEU	3.3
1	A	24	ASN	3.2

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Mol	Chain	Res	Type	RSRZ
1	A	142	SER	3.0
1	A	510	GLY	2.9
1	A	23	SER	2.8
1	A	172	LEU	2.8
1	A	403	ALA	2.7
1	A	574	VAL	2.5
1	A	180	VAL	2.4
1	A	429	ASN	2.4
1	A	391[A]	ASN	2.3
1	A	531	ALA	2.2
1	A	201	GLY	2.2
1	A	430	GLY	2.1
1	A	508	GLY	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(Å <sup>2</sup> )	Q<0.9
2	SO4	A	901	5/5	0.97	0.11	1.44	20,21,28,28	0
3	FKD	A	700	18/19	0.97	0.09	-1.06	10,13,16,17	0
2	SO4	A	902	5/5	0.90	0.25	-	54,55,56,56	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.