Full wwPDB X-ray Structure Validation Report (i)

May 21, 2020 – 11:42 pm BST

PDB ID	:	3KT7
Title	:	Crystal structure of Tpa1 from Saccharomyces cerevisiae, a component of the messenger ribonucleoprotein complex
Authors	:	Kim, H.S.; Kim, H.L.; Kim, K.H.; Kim, D.J.; Lee, S.J.; Yoon, J.Y.; Yoon, H.J.; Lee, H.Y.; Park, S.B.; Kim, S.-J.; Lee, J.Y.; Suh, S.W.
Deposited on	:	2009-11-24
Resolution	:	1.77 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 following versions of software and data (see references (i)) 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	:	2.11
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)	:	2.11

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 1.77 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.
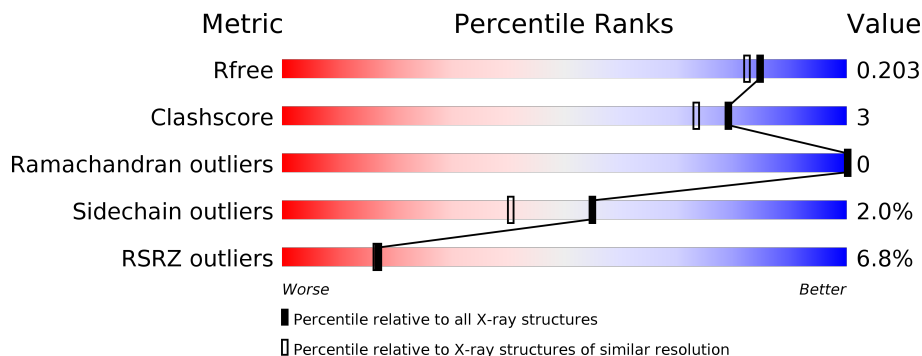
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	9185 (1.80-1.76)
Clashscore	141614	10184 (1.80-1.76)
Ramachandran outliers	138981	10051 (1.80-1.76)
Sidechain outliers	138945	10050 (1.80-1.76)
RSRZ outliers	127900	9032 (1.80-1.76)

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 >=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	633	

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 5477 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 PKHD-type hydroxylase TPA1.

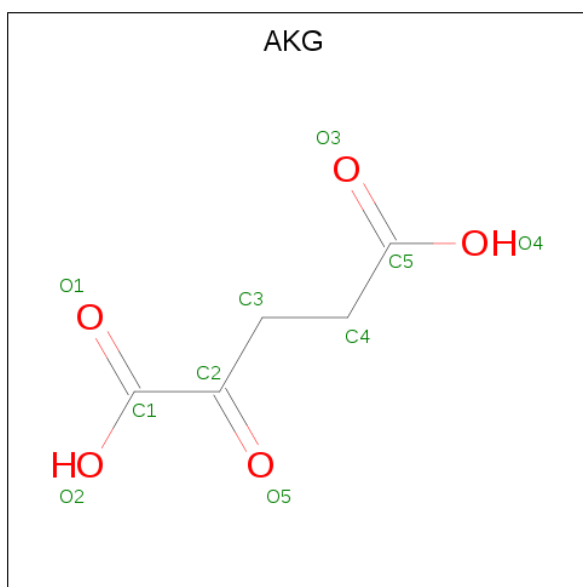| Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	558	Total 4649	C 2979	N 778	O 878	S 14	0	12	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	20	MET	-	EXPRESSION TAG	UNP P40032
A	645	LEU	-	EXPRESSION TAG	UNP P40032
A	646	GLU	-	EXPRESSION TAG	UNP P40032
A	647	HIS	-	EXPRESSION TAG	UNP P40032
A	648	HIS	-	EXPRESSION TAG	UNP P40032
A	649	HIS	-	EXPRESSION TAG	UNP P40032
A	650	HIS	-	EXPRESSION TAG	UNP P40032
A	651	HIS	-	EXPRESSION TAG	UNP P40032
A	652	HIS	-	EXPRESSION TAG	UNP P40032

- Molecule 2 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total 1	Fe 1	0	0

- Molecule 3 is 2-OXOGLUTARIC ACID (three-letter code: AKG) (formula: $C_5H_6O_5$).

AKG

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			10	5	5		

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

SO4

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

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WORLDWIDE
PDB
PROTEIN DATA BANK

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

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total 6	C 3	O 3	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	791	Total 791	O 791	0	0

3 Residue-property plots ⓘ

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: PKHD-type hydroxylase TPA1

Chain A:
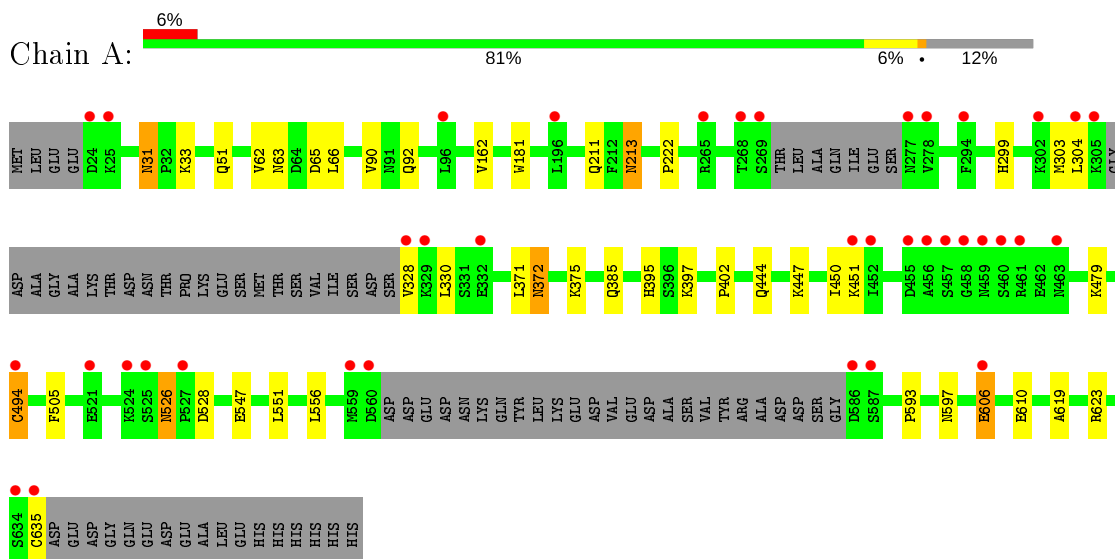
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 3 2 1	Depositor
Cell constants a, b, c, α, β, γ	136.29Å 136.29Å 79.83Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	20.00 – 1.77 19.76 – 1.77	Depositor EDS
% Data completeness (in resolution range)	99.3 (20.00-1.77) 99.3 (19.76-1.77)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	1.36 (at 1.77Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.179 , 0.205 0.178 , 0.203	Depositor DCC
R_{free} test set	4126 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	22.5	Xtriage
Anisotropy	0.010	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 51.9	EDS
L-test for twinning[2]	$<|L|> = 0.51, <L^2> = 0.35$	Xtriage
Estimated twinning fraction	0.015 for -h,-k,l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	5477	wwPDB-VP
Average B, all atoms (Å^2)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.52% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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: GOL, LVN, AKG, FE, 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	0.39	0/4756	0.53	0/6427

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	A	4649	0	4561	26	1
2	A	1	0	0	0	0
3	A	10	0	4	0	0
4	A	20	0	0	0	0
5	A	6	0	8	0	0
6	A	791	0	0	3	1
All	All	5477	0	4573	26	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 3.

All (26) 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:371:LEU:H	1:A:597:ASN:HD21	1.16	0.91
1:A:62:VAL:H	1:A:213:ASN:HD21	1.34	0.75
1:A:181:TRP:H	1:A:211:GLN:HE22	1.40	0.69
1:A:90[B]:VAL:HG23	1:A:92:GLN:HG3	1.76	0.68
1:A:63:ASN:HD22	1:A:66:LEU:H	1.42	0.67
1:A:547:GLU:HG3	1:A:593:PRO:HG2	1.81	0.62
1:A:606:GLU:HG2	6:A:817:HOH:O	2.00	0.60
1:A:372:ASN:HD22	1:A:372:ASN:C	2.07	0.57
1:A:31:ASN:HD22	1:A:33:LYS:H	1.57	0.53
1:A:372:ASN:ND2	1:A:375:LYS:H	2.06	0.53
1:A:162:VAL:HG21	1:A:222:PRO:HA	1.94	0.50
1:A:551:LEU:HD13	1:A:619:ALA:HA	1.94	0.48
1:A:371:LEU:H	1:A:597:ASN:ND2	1.98	0.47
1:A:62:VAL:H	1:A:213:ASN:ND2	2.08	0.45
1:A:402:PRO:HG3	1:A:450:ILE:HD11	1.98	0.44
1:A:494[A]:CYS:HB2	1:A:635:CYS:HB2	1.76	0.44
1:A:505:PHE:HB2	1:A:623:ARG:HB3	2.00	0.43
1:A:395:HIS:ND1	1:A:397:LYS:HG2	2.35	0.42
1:A:526:ASN:HD22	1:A:528:ASP:H	1.68	0.42
1:A:606:GLU:CG	6:A:817:HOH:O	2.64	0.42
1:A:63:ASN:HD21	1:A:65:ASP:HB2	1.84	0.41
1:A:447:LYS:HE2	1:A:451:LYS:NZ	2.35	0.41
1:A:303:MET:O	1:A:328:VAL:N	2.54	0.41
1:A:304:LEU:HD12	1:A:494[B]:CYS:SG	2.61	0.40
1:A:556:LEU:O	1:A:610:GLU:HA	2.22	0.40
1:A:444:GLN:NE2	6:A:1130:HOH:O	2.54	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:479:LYS:NZ	6:A:916:HOH:O[4_555]	2.05	0.15

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	561/633 (89%)	548 (98%)	13 (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	A	519/572 (91%)	508 (98%)	11 (2%)	53	38

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

Mol	Chain	Res	Type
1	A	31	ASN
1	A	51	GLN
1	A	213	ASN
1	A	299	HIS
1	A	330	LEU
1	A	372	ASN
1	A	385	GLN
1	A	494[A]	CYS
1	A	494[B]	CYS
1	A	526	ASN
1	A	606	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (22) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	31	ASN
1	A	40	GLN
1	A	51	GLN
1	A	54	ASN
1	A	63	ASN

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Mol	Chain	Res	Type
1	A	92	GLN
1	A	148	ASN
1	A	198	ASN
1	A	211	GLN
1	A	213	ASN
1	A	214	GLN
1	A	242	GLN
1	A	249	GLN
1	A	299	HIS
1	A	358	GLN
1	A	372	ASN
1	A	385	GLN
1	A	390	GLN
1	A	438	ASN
1	A	499	GLN
1	A	526	ASN
1	A	597	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)

1 non-standard protein/DNA/RNA residue is 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	#$|Z| > 2$
1	LVN	A	229	1	6,7,8	1.44	1 (16%)	5,8,10	0.87	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
1	LVN	A	229	1	-	0/4/8/10	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	229	LVN	CB-CA	-2.87	1.52	1.55

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.

5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 7 ligands modelled in this entry, 1 is monoatomic - leaving 6 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	AKG	A	702	2	3,9,9	0.56	0	4,11,11	0.51	0
4	SO4	A	704	-	4,4,4	0.14	0	6,6,6	0.09	0
4	SO4	A	703	-	4,4,4	0.15	0	6,6,6	0.14	0
5	GOL	A	707	-	5,5,5	0.36	0	5,5,5	0.22	0
4	SO4	A	705	-	4,4,4	0.14	0	6,6,6	0.11	0
4	SO4	A	706	-	4,4,4	0.16	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.

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'-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	AKG	A	702	2	-	0/3/9/9	-
5	GOL	A	707	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	707	GOL	O1-C1-C2-C3
5	A	707	GOL	O1-C1-C2-O2

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(Å²)	Q<0.9
1	A	557/633 (87%)	0.21	38 (6%)	17	17	14, 20, 41, 49	0

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	328	VAL	10.6
1	A	269	SER	9.1
1	A	277	ASN	8.6
1	A	635	CYS	7.4
1	A	96	LEU	7.4
1	A	457	SER	7.1
1	A	586	ASP	6.9
1	A	278	VAL	6.6
1	A	305	LYS	6.5
1	A	456	ALA	5.9
1	A	459	ASN	5.0
1	A	268	THR	5.0
1	A	458	GLY	4.7
1	A	455	ASP	4.4
1	A	527	PRO	4.3
1	A	25	LYS	3.9
1	A	559	MET	3.8
1	A	452	ILE	3.5
1	A	304	LEU	3.5
1	A	524	LYS	3.5
1	A	329	LYS	3.3
1	A	634	SER	3.2
1	A	294	PHE	3.1
1	A	461	ARG	3.1
1	A	560	ASP	3.1
1	A	332	GLU	3.0
1	A	494[A]	CYS	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	460	SER	2.9
1	A	302	LYS	2.8
1	A	265	ARG	2.7
1	A	587	SER	2.7
1	A	196	LEU	2.7
1	A	521	GLU	2.6
1	A	525	SER	2.5
1	A	451	LYS	2.5
1	A	24	ASP	2.4
1	A	463	ASN	2.2
1	A	606	GLU	2.1

6.2 Non-standard residues in protein, DNA, RNA chains (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
1	LVN	A	229	8/9	0.95	0.14	14,14,15,19	1

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. 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
5	GOL	A	707	6/6	0.50	0.29	36,41,42,43	0
4	SO4	A	704	5/5	0.83	0.30	60,60,60,61	0
4	SO4	A	705	5/5	0.92	0.19	56,56,56,56	0
4	SO4	A	706	5/5	0.92	0.19	43,43,43,43	0
3	AKG	A	702	10/10	0.96	0.08	20,21,22,22	0
4	SO4	A	703	5/5	0.99	0.05	22,22,22,22	5

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
2	FE	A	701	1/1	1.00	0.05	17,17,17,17	0

6.5 Other polymers (i)

There are no such residues in this entry.