



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 1, 2014 – 04:17 AM GMT

PDB ID : 2C4U
Title : CRYSTAL STRUCTURE OF THE APO FORM OF THE 5'-FLUORO-5'-DEOXYADENOSINESYNTHASE ENZYME FROM STREPTOMYCES CATTLEYA
Authors : Mcewan, A.R.; Deng, H.; Robinson, D.A.; Delaurentis, W.; McGlinchey, R.P.; O'Hagan, D.; Naismith, J.H.
Deposited on : 2005-10-22
Resolution : 2.50 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

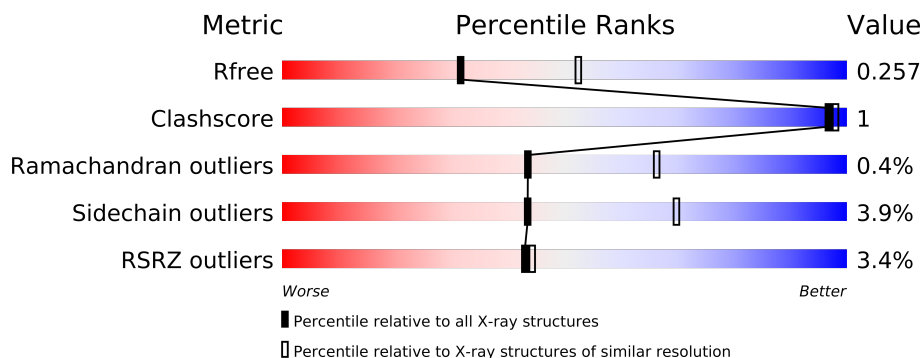
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance

The reported resolution of this entry is 2.50 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}	66092	2784 (2.50-2.50)
Clashscore	79885	3562 (2.50-2.50)
Ramachandran outliers	78287	3480 (2.50-2.50)
Sidechain outliers	78261	3482 (2.50-2.50)
RSRZ outliers	66119	2785 (2.50-2.50)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	299	
1	B	299	
1	C	299	
1	D	299	
1	E	299	
1	F	299	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
2	GOL	A	1299	-	X
2	GOL	A	1301	-	X

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 13825 atoms, of which 0 are hydrogen and 0 are deuterium.

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 5'-FLUORO-5'-DEOXYADENOSINESYNTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	291	Total	C	N	O	S	0	1	0
			2225	1413	378	426	8			
1	B	291	Total	C	N	O	S	0	1	0
			2225	1413	378	426	8			
1	C	291	Total	C	N	O	S	0	1	0
			2225	1413	378	426	8			
1	D	291	Total	C	N	O	S	0	1	0
			2225	1413	378	426	8			
1	E	291	Total	C	N	O	S	0	1	0
			2225	1413	378	426	8			
1	F	291	Total	C	N	O	S	0	1	0
			2225	1413	378	426	8			

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C O 6 3 3	0	0
2	A	1	Total C O 6 3 3	0	0
2	A	1	Total C O 6 3 3	0	0
2	B	1	Total C O 6 3 3	0	0
2	C	1	Total C O 6 3 3	0	0
2	C	1	Total C O 6 3 3	0	0
2	D	1	Total C O 6 3 3	0	0
2	D	1	Total C O 6 3 3	0	0
2	E	1	Total C O 6 3 3	0	0
2	F	1	Total C O 6 3 3	0	0
2	F	1	Total C O 6 3 3	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	85	Total O 85 85	0	0
3	B	88	Total O 88 88	0	0
3	C	61	Total O 61 61	0	0
3	D	38	Total O 38 38	0	0
3	E	82	Total O 82 82	0	0
3	F	55	Total O 55 55	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 errors 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.

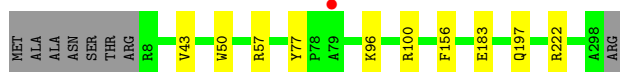
• Molecule 1: 5'-FLUORO-5'-DEOXYADENOSINESYNTHASE

Chain A: 



• Molecule 1: 5'-FLUORO-5'-DEOXYADENOSINESYNTHASE

Chain B: 



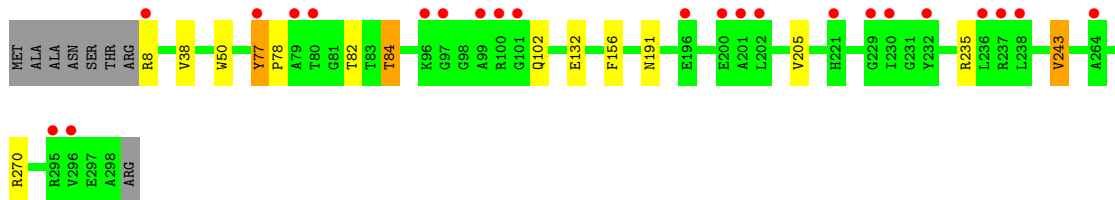
• Molecule 1: 5'-FLUORO-5'-DEOXYADENOSINESYNTHASE

Chain C: 



• Molecule 1: 5'-FLUORO-5'-DEOXYADENOSINESYNTHASE

Chain D: 



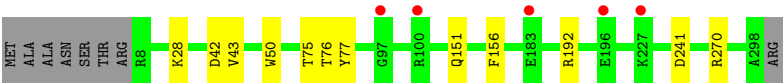
• Molecule 1: 5'-FLUORO-5'-DEOXYADENOSINESYNTHASE

Chain E: 



• Molecule 1: 5'-FLUORO-5'-DEOXYADENOSINESYNTHASE

Chain F: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	103.91Å 128.06Å 146.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	96.23 – 2.50 73.25 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.3 (96.23-2.50) 99.3 (73.25-2.50)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.10 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.215 , 0.273 0.210 , 0.257	Depositor DCC
R_{free} test set	3410 reflections (5.04%)	DCC
Wilson B-factor (Å ²)	35.6	Xtriage
Anisotropy	0.224	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 5.0	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Outliers	5 of 67742 reflections (0.007%)	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	13825	wwPDB-VP
Average B, all atoms (Å ²)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 51.79 % of the origin peak, indicating pseudo translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo translational symmetry is equal to 5.3352e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

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

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	0.60	0/2284	0.66	0/3117
1	B	0.63	0/2284	0.68	0/3117
1	C	0.57	0/2284	0.65	0/3117
1	D	0.59	0/2284	0.68	0/3117
1	E	0.64	0/2284	0.68	0/3117
1	F	0.58	0/2284	0.67	0/3117
All	All	0.60	0/13704	0.67	0/18702

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	F	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	F	75	THR	Peptide

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit,

and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2225	0	0	3	0
1	B	2225	0	0	3	0
1	C	2225	0	0	3	0
1	D	2225	0	0	2	0
1	E	2225	0	0	2	0
1	F	2225	0	0	1	0
2	A	18	0	0	0	0
2	B	6	0	0	0	0
2	C	12	0	0	0	0
2	D	12	0	0	0	0
2	E	6	0	0	0	0
2	F	12	0	0	0	0
3	A	85	0	0	0	0
3	B	88	0	0	3	0
3	C	61	0	0	0	0
3	D	38	0	0	0	0
3	E	82	0	0	0	0
3	F	55	0	0	0	0
All	All	13825	0	0	14	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 1.

All (14) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:E:268:ASN:O	1:E:270:ARG:N	2.39	0.54
1:B:57:ARG:NH1	3:B:2018:HOH:O	2.46	0.49
1:B:222:ARG:NH2	3:B:2057:HOH:O	2.46	0.48
1:A:132:GLU:OE1	1:A:192:ARG:NH1	2.48	0.46
1:C:8:ARG:NE	1:C:8:ARG:N	2.63	0.46
1:C:28:LYS:NZ	1:C:42:ASP:OD2	2.48	0.45
1:F:28:LYS:NZ	1:F:42:ASP:OD2	2.50	0.45
1:C:80:THR:OG1	1:C:154:PRO:O	2.34	0.44
1:A:60:VAL:O	1:A:134:HIS:NE2	2.52	0.43
1:D:82:THR:OG1	1:D:84:THR:CG2	2.69	0.41
1:A:66:PHE:O	1:A:117:TYR:OH	2.38	0.41
1:B:96:LYS:NZ	3:B:2023:HOH:O	2.54	0.41
1:D:77:TYR:O	1:D:78:PRO:C	2.60	0.40
1:E:268:ASN:C	1:E:270:ARG:N	2.75	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone ⓘ

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	290/299 (97%)	273 (94%)	15 (5%)	2 (1%)	30	50
1	B	290/299 (97%)	280 (97%)	9 (3%)	1 (0%)	50	73
1	C	290/299 (97%)	272 (94%)	18 (6%)	0	100	100
1	D	290/299 (97%)	273 (94%)	16 (6%)	1 (0%)	50	73
1	E	290/299 (97%)	277 (96%)	11 (4%)	2 (1%)	30	50
1	F	290/299 (97%)	274 (94%)	15 (5%)	1 (0%)	50	73
All	All	1740/1794 (97%)	1649 (95%)	84 (5%)	7 (0%)	43	66

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	96	LYS
1	E	269	SER
1	A	269	SER
1	F	43	VAL
1	E	252	PRO
1	B	43	VAL
1	D	243	VAL

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	232/237 (98%)	225 (97%)	7 (3%)	53	80

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	232/237 (98%)	226 (97%)	6 (3%)	59	84
1	C	232/237 (98%)	222 (96%)	10 (4%)	40	65
1	D	232/237 (98%)	219 (94%)	13 (6%)	30	51
1	E	232/237 (98%)	222 (96%)	10 (4%)	40	65
1	F	232/237 (98%)	224 (97%)	8 (3%)	49	75
All	All	1392/1422 (98%)	1338 (96%)	54 (4%)	43	70

All (54) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	50	TRP
1	A	77	TYR
1	A	102	GLN
1	A	132	GLU
1	A	156	PHE
1	A	205	VAL
1	A	235	ARG
1	B	50	TRP
1	B	77	TYR
1	B	100	ARG
1	B	156	PHE
1	B	183	GLU
1	B	197	GLN
1	C	8	ARG
1	C	77	TYR
1	C	84	THR
1	C	133	GLU
1	C	156	PHE
1	C	183	GLU
1	C	191	ASN
1	C	197	GLN
1	C	238	LEU
1	C	241	ASP
1	D	8	ARG
1	D	38	VAL
1	D	50	TRP
1	D	77	TYR
1	D	84	THR
1	D	102	GLN
1	D	132	GLU

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Mol	Chain	Res	Type
1	D	156	PHE
1	D	191	ASN
1	D	205	VAL
1	D	235	ARG
1	D	243	VAL
1	D	270	ARG
1	E	50	TRP
1	E	52	VAL
1	E	77	TYR
1	E	156	PHE
1	E	197	GLN
1	E	224	ASP
1	E	226	GLU
1	E	235	ARG
1	E	256	ASP
1	E	270	ARG
1	F	50	TRP
1	F	76	THR
1	F	77	TYR
1	F	151	GLN
1	F	156	PHE
1	F	192	ARG
1	F	241	ASP
1	F	270	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA chains in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry

11 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$
2	GOL	A	1299	-	5,5,5	0.34	0	5,5,5	0.85	0
2	GOL	A	1300	-	5,5,5	0.41	0	5,5,5	0.52	0
2	GOL	A	1301	-	5,5,5	0.30	0	5,5,5	0.56	0
2	GOL	B	1299	-	5,5,5	0.49	0	5,5,5	0.44	0
2	GOL	C	1299	-	5,5,5	0.40	0	5,5,5	0.78	0
2	GOL	C	1300	-	5,5,5	0.39	0	5,5,5	0.35	0
2	GOL	D	1299	-	5,5,5	0.32	0	5,5,5	0.67	0
2	GOL	D	1300	-	5,5,5	0.25	0	5,5,5	0.57	0
2	GOL	E	1299	-	5,5,5	0.14	0	5,5,5	0.62	0
2	GOL	F	1299	-	5,5,5	0.40	0	5,5,5	0.34	0
2	GOL	F	1300	-	5,5,5	0.32	0	5,5,5	0.51	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
2	GOL	A	1299	-	-	0/4/4/4	0/0/0/0
2	GOL	A	1300	-	-	0/4/4/4	0/0/0/0
2	GOL	A	1301	-	-	0/4/4/4	0/0/0/0
2	GOL	B	1299	-	-	0/4/4/4	0/0/0/0
2	GOL	C	1299	-	-	0/4/4/4	0/0/0/0
2	GOL	C	1300	-	-	0/4/4/4	0/0/0/0
2	GOL	D	1299	-	-	0/4/4/4	0/0/0/0
2	GOL	D	1300	-	-	0/4/4/4	0/0/0/0
2	GOL	E	1299	-	-	0/4/4/4	0/0/0/0
2	GOL	F	1299	-	-	0/4/4/4	0/0/0/0
2	GOL	F	1300	-	-	0/4/4/4	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.

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, 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	291/299 (97%)	0.29	9 (3%) 47 48	3, 15, 36, 49	0
1	B	291/299 (97%)	0.10	1 (0%) 91 93	3, 12, 26, 36	0
1	C	291/299 (97%)	0.26	12 (4%) 35 36	5, 13, 30, 39	0
1	D	291/299 (97%)	0.41	23 (7%) 13 12	2, 16, 37, 50	0
1	E	291/299 (97%)	0.31	10 (3%) 43 44	2, 13, 34, 45	0
1	F	291/299 (97%)	0.15	5 (1%) 67 69	3, 13, 27, 36	0
All	All	1746/1794 (97%)	0.25	60 (3%) 43 44	2, 13, 33, 50	0

All (60) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	201	ALA	6.3
1	D	79	ALA	5.6
1	A	201	ALA	4.6
1	A	100	ARG	4.3
1	D	230	ILE	4.1
1	D	80	THR	4.0
1	E	100	ARG	3.9
1	E	95	ALA	3.9
1	D	96	LYS	3.7
1	E	99	ALA	3.7
1	D	200	GLU	3.7
1	E	201	ALA	3.5
1	D	232	TYR	3.4
1	A	202	LEU	3.4
1	D	238	LEU	3.4
1	E	98	GLY	3.3
1	F	100	ARG	3.3
1	C	242	GLY	3.3
1	D	8	ARG	3.1

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Mol	Chain	Res	Type	RSRZ
1	D	229	GLY	3.1
1	C	200	GLU	3.1
1	D	296	VAL	3.0
1	C	227	LYS	3.0
1	D	202	LEU	3.0
1	D	237	ARG	2.9
1	A	257	ALA	2.9
1	C	61[A]	ASP	2.8
1	D	295	ARG	2.7
1	D	236	LEU	2.7
1	F	227	LYS	2.7
1	A	101	GLY	2.6
1	D	196	GLU	2.5
1	E	269	SER	2.5
1	B	79	ALA	2.5
1	D	100	ARG	2.5
1	C	201	ALA	2.5
1	E	200	GLU	2.4
1	C	196	GLU	2.4
1	C	79	ALA	2.4
1	D	77	TYR	2.4
1	C	99	ALA	2.3
1	A	99	ALA	2.3
1	A	200	GLU	2.3
1	D	97	GLY	2.3
1	A	295	ARG	2.2
1	C	101	GLY	2.2
1	E	232	TYR	2.2
1	E	202	LEU	2.2
1	C	100	ARG	2.2
1	D	221	HIS	2.2
1	C	225	LEU	2.2
1	D	99	ALA	2.2
1	F	183	GLU	2.2
1	D	101	GLY	2.1
1	E	235	ARG	2.1
1	F	196	GLU	2.1
1	F	97	GLY	2.0
1	A	96	LYS	2.0
1	D	264	ALA	2.0
1	C	235	ARG	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands ⓘ

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, 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
2	GOL	A	1299	6/6	0.21	2.65	30,30,31,31	0
2	GOL	A	1301	6/6	0.28	2.26	47,47,47,48	0
2	GOL	C	1299	6/6	0.18	1.26	11,13,15,15	0
2	GOL	C	1300	6/6	0.21	1.24	29,30,30,31	0
2	GOL	F	1300	6/6	0.19	1.04	20,22,22,23	0
2	GOL	D	1300	6/6	0.27	0.96	24,28,29,31	0
2	GOL	E	1299	6/6	0.16	-0.06	10,11,13,16	0
2	GOL	F	1299	6/6	0.15	-0.27	12,13,14,17	0
2	GOL	D	1299	6/6	0.16	-0.54	10,13,16,19	0
2	GOL	B	1299	6/6	0.11	-2.48	6,8,10,12	0
2	GOL	A	1300	6/6	0.12	-2.83	8,12,13,13	0

6.5 Other polymers ⓘ

There are no such residues in this entry.