



Full wwPDB X-ray Structure Validation Report

Feb 27, 2014 – 10:41 PM GMT

PDB ID : 4DMR
Title : REDUCED DMSO REDUCTASE FROM RHODOBACTER CAPSULATUS
WITH BOUND DMSO SUBSTRATE
Authors : Mcalpine, A.S.; Bailey, S.
Deposited on : 1997-04-30
Resolution : 1.90 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>

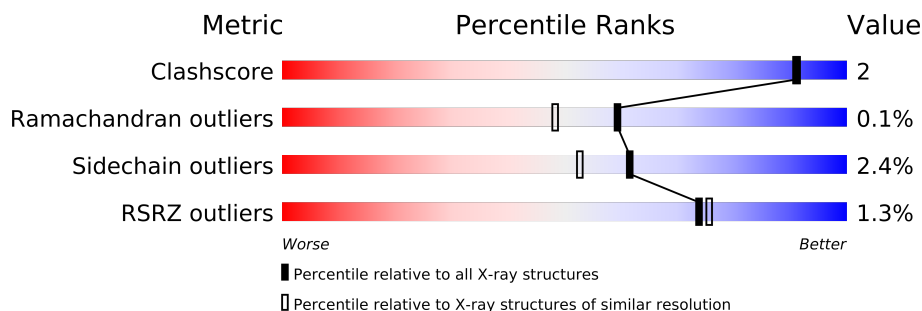
The following versions of software and data (see [references](#)) were used in the production of this report:

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 1.90 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))
Clashscore	79885	4465 (1.90-1.90)
Ramachandran outliers	78287	4413 (1.90-1.90)
Sidechain outliers	78261	4414 (1.90-1.90)
RSRZ outliers	66119	3686 (1.90-1.90)

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	823	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6507 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.

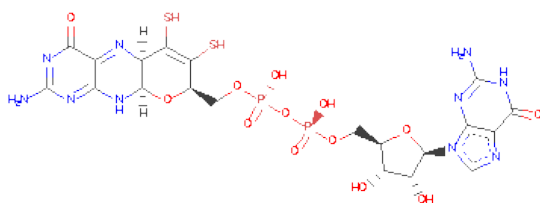
- Molecule 1 is a protein called DMSO REDUCTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	773	Total	C	N	O	S	0	0	0
			5933	3775	1005	1126	27			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	39	SER	THR	DIFFERENCES IN MAP	UNP Q52675
A	43	ALA	GLU	DIFFERENCES IN MAP	UNP Q52675
A	107	SER	GLN	CONFLICT	UNP Q52675
A	234	GLU	ASP	DIFFERENCES IN MAP	UNP Q52675
A	236	ILE	VAL	DIFFERENCES IN MAP	UNP Q52675
A	280	ASP	MET	DIFFERENCES IN MAP	UNP Q52675
A	294	GLU	SER	DIFFERENCES IN MAP	UNP Q52675
A	295	GLY	ASP	DIFFERENCES IN MAP	UNP Q52675
A	312	GLU	ILE	DIFFERENCES IN MAP	UNP Q52675
A	374	ALA	SER	CONFLICT	UNP Q52675
A	456	VAL	ILE	DIFFERENCES IN MAP	UNP Q52675
A	526	ALA	LYS	CONFLICT	UNP Q52675
A	552	ALA	GLY	MISSING FROM GB	UNP Q52675
A	555	GLN	GLU	CONFLICT	UNP Q52675

- Molecule 2 is 2-AMINO-5,6-DIMERCAPTO-7-METHYL-3,7,8A,9-TETRAHYDRO-8-OXA-1,3,9,10-TETRAAZA-ANTHRACEN-4-ONEGUANOSINE DINUCLEOTIDE (three-letter code: PGD) (formula: C₂₀H₂₄N₁₀O₁₃P₂S₂).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
2	A	1	Total	C	N	O	P	S	0	0
			47	20	10	13	2	2		
2	A	1	Total	C	N	O	P	S	0	0
			47	20	10	13	2	2		

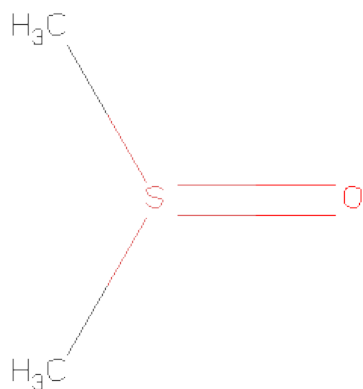
- Molecule 3 is MOLYBDENUM(IV) ION (three-letter code: 4MO) (formula: Mo).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Mo	0	0
			1	1		

- Molecule 4 is OXYGEN ATOM (three-letter code: O) (formula: O).

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

- Molecule 5 is DIMETHYL SULFOXIDE (three-letter code: DMS) (formula: C₂H₆OS).



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

- Molecule 6 is water.

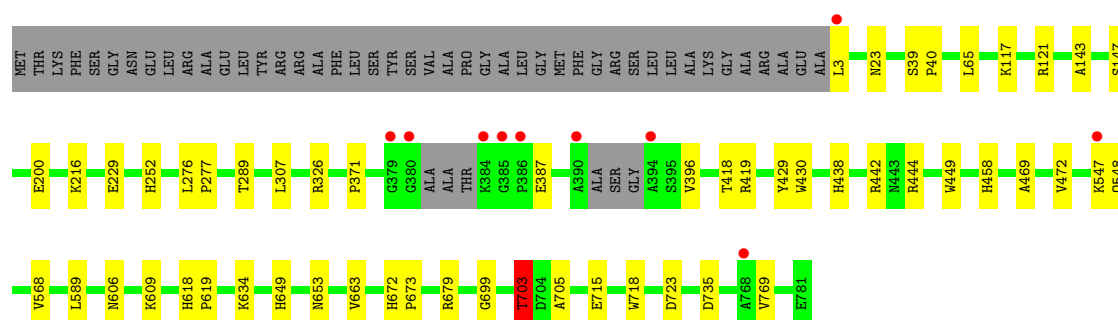
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	474	Total	O	0	0
			474	474		

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: DMSO REDUCTASE

Chain A: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	80.97Å 80.97Å 230.13Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.90 17.29 – 1.90	Depositor EDS
% Data completeness (in resolution range)	96.6 (20.00-1.90) 95.8 (17.29-1.90)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.77 (at 1.90Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.160 , 0.196 0.166 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	DCC
Wilson B-factor (Å ²)	15.0	Xtriage
Anisotropy	0.008	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 41.4	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	0 of 58701 reflections	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	6507	wwPDB-VP
Average B, all atoms (Å ²)	16.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.36% of the height of the origin peak. No significant pseudotranslation is detected.*

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: PGD, DMS, O, 4MO

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	0.41	0/6092	0.94	11/8290 (0.1%)

There are no bond length outliers.

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	121	ARG	CD-NE-CZ	7.87	134.62	123.60
1	A	326	ARG	NE-CZ-NH1	7.10	123.85	120.30
1	A	442	ARG	NE-CZ-NH2	-7.09	116.76	120.30
1	A	723	ASP	CB-CG-OD1	5.75	123.47	118.30
1	A	735	ASP	CB-CG-OD1	5.64	123.38	118.30
1	A	442	ARG	NE-CZ-NH1	5.61	123.11	120.30
1	A	703	THR	CB-CA-C	-5.60	96.48	111.60
1	A	458	HIS	N-CA-CB	5.29	120.13	110.60
1	A	568	VAL	CB-CA-C	-5.22	101.49	111.40
1	A	444	ARG	NE-CZ-NH1	5.08	122.84	120.30
1	A	679	ARG	NE-CZ-NH2	-5.01	117.79	120.30

There are no chirality outliers.

There are no planarity outliers.

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	5933	0	5739	18	3
2	A	94	0	40	3	0
3	A	1	0	0	0	0
4	A	1	0	0	4	0
5	A	4	0	6	3	0
6	A	474	0	0	2	3
All	All	6507	0	5785	21	3

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 2.

All (21) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
4:A:785:O:O	5:A:786:DMS:O	1.90	0.88
1:A:147:SER:OG	4:A:785:O:O	1.98	0.80
1:A:606:ASN:OD1	6:A:1066:HOH:O	2.16	0.60
1:A:147:SER:HB3	2:A:783:PGD:S12	2.47	0.55
1:A:147:SER:OG	5:A:786:DMS:S	2.65	0.55
4:A:785:O:O	5:A:786:DMS:S	2.66	0.53
1:A:276:LEU:HB3	1:A:277:PRO:HD3	1.92	0.50
1:A:589:LEU:HD12	6:A:1194:HOH:O	2.15	0.46
1:A:653:ASN:ND2	1:A:718:TRP:H	2.12	0.46
1:A:618:HIS:HB2	1:A:619:PRO:HD2	1.98	0.46
1:A:469:ALA:HB3	1:A:472:VAL:HG22	1.98	0.46
1:A:672:HIS:CG	1:A:673:PRO:HD2	2.55	0.42
1:A:649:HIS:CG	2:A:782:PGD:H102	2.54	0.41
1:A:663:VAL:HB	1:A:699:GLY:HA3	2.01	0.41
1:A:703:THR:HG22	1:A:705:ALA:H	1.85	0.41
1:A:371:PRO:HB3	1:A:548:GLN:HG2	2.03	0.41
1:A:39:SER:HA	1:A:40:PRO:HD3	1.93	0.40
1:A:143:ALA:HB2	1:A:396:VAL:CG1	2.51	0.40
2:A:782:PGD:S13	4:A:785:O:O	2.79	0.40
1:A:252:HIS:CE1	1:A:289:THR:HG22	2.57	0.40
1:A:3:LEU:HD13	1:A:23:ASN:O	2.22	0.40

All (3) 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	Distance(Å)	Clash(Å)
1:A:418:THR:CG2	6:A:1249:HOH:O[5_445]	2.04	0.16
1:A:229:GLU:CG	6:A:1228:HOH:O[5_455]	2.13	0.07
1:A:634:LYS:NZ	6:A:1198:HOH:O[3_555]	2.19	0.01

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	767/823 (93%)	752 (98%)	14 (2%)	1 (0%)	59 48

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	117	LYS

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	614/648 (95%)	599 (98%)	15 (2%)	61 53

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	65	LEU
1	A	200	GLU
1	A	216	LYS
1	A	307	LEU
1	A	387	GLU
1	A	419	ARG
1	A	429	TYR
1	A	430	TRP
1	A	438	HIS
1	A	449	TRP
1	A	547	LYS
1	A	609	LYS
1	A	703	THR

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Mol	Chain	Res	Type
1	A	715	GLU
1	A	769	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	241	GLN
1	A	653	ASN

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 ⓘ

Of 5 ligands modelled in this entry, 2 are monoatomic - leaving 3 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	$\# Z > 2$
2	PGD	A	782	3,4	52,52,52	3.01	17 (32%)	72,81,81	4.27	10 (13%)
2	PGD	A	783	3	52,52,52	2.96	16 (30%)	72,81,81	4.52	12 (16%)
5	DMS	A	786	3	3,3,3	1.75	1 (33%)	3,3,3	1.51	1 (33%)

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	PGD	A	782	3,4	-	0/22/82/82	0/1/6/6
2	PGD	A	783	3	-	0/22/82/82	0/1/6/6
5	DMS	A	786	3	-	0/0/0/0	0/0/0/0

All (34) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	782	PGD	C16-N15	13.77	1.44	1.28
2	A	783	PGD	C16-N15	13.31	1.43	1.28
2	A	783	PGD	C21-N22	8.20	1.43	1.35
2	A	782	PGD	C21-N22	7.22	1.42	1.35
2	A	783	PGD	C2-N2	6.02	1.41	1.32
2	A	782	PGD	C2-N2	6.02	1.41	1.32
2	A	782	PGD	PB-O1B	5.51	1.72	1.51
2	A	783	PGD	PB-O1B	5.18	1.71	1.51
2	A	783	PGD	PA-O1A	4.99	1.70	1.51
2	A	782	PGD	PA-O1A	4.38	1.68	1.51
2	A	782	PGD	C2-N3	3.88	1.38	1.33
2	A	782	PGD	PA-O2A	3.59	1.71	1.55
2	A	782	PGD	C19-N19	3.55	1.42	1.34
2	A	783	PGD	PB-O2B	3.41	1.70	1.55
2	A	783	PGD	C19-N19	3.40	1.42	1.34
2	A	783	PGD	PA-O2A	3.30	1.69	1.55
2	A	782	PGD	PB-O5'	3.30	1.74	1.59
2	A	783	PGD	PA-O3A	3.29	1.74	1.59
2	A	783	PGD	PB-O5'	2.98	1.72	1.59
5	A	786	DMS	O-S	2.95	1.70	1.50
2	A	782	PGD	PA-O3A	2.93	1.72	1.59
2	A	782	PGD	PB-O2B	2.74	1.67	1.55
2	A	782	PGD	PA-O3B	2.73	1.64	1.59
2	A	783	PGD	C17-C16	-2.69	1.39	1.47
2	A	783	PGD	C4-N9	-2.56	1.34	1.37
2	A	783	PGD	O11-C23	-2.47	1.40	1.44
2	A	782	PGD	C4-N9	-2.39	1.34	1.37
2	A	782	PGD	C17-C16	-2.32	1.40	1.47
2	A	782	PGD	PB-O3B	2.27	1.64	1.59
2	A	783	PGD	C2-N3	2.22	1.36	1.33
2	A	783	PGD	C12-S12	2.13	1.82	1.74
2	A	783	PGD	C5-C4	-2.10	1.35	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	782	PGD	C5-C4	-2.04	1.35	1.40
2	A	782	PGD	C10-C11	2.04	1.55	1.52

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	783	PGD	C6-C5-N7	-35.51	129.36	134.14
2	A	782	PGD	C6-C5-N7	-34.15	129.54	134.14
2	A	783	PGD	C4'-O4'-C1'	-5.88	103.36	109.75
2	A	782	PGD	C17-C16-N15	5.44	123.68	117.94
2	A	783	PGD	C17-C16-N15	5.37	123.60	117.94
2	A	783	PGD	N19-C19-N18	4.25	122.67	117.14
2	A	783	PGD	C8-N9-C4	-4.02	103.83	106.90
2	A	782	PGD	C8-N9-C4	-3.97	103.87	106.90
2	A	783	PGD	N20-C19-N18	-3.97	120.15	126.41
2	A	782	PGD	N20-C19-N18	-2.98	121.70	126.41
2	A	783	PGD	O11-C11-C12	2.82	116.78	109.81
2	A	782	PGD	C21-C16-N15	-2.79	117.03	124.33
2	A	782	PGD	O4'-C1'-C2'	-2.75	102.55	106.77
2	A	782	PGD	O4'-C1'-N9	-2.69	105.94	108.44
2	A	783	PGD	C10-C11-C12	2.68	114.14	110.98
2	A	783	PGD	PA-O3B-PB	2.51	139.05	131.68
2	A	783	PGD	C21-C16-N15	-2.32	118.25	124.33
2	A	783	PGD	C5-C4-N3	-2.31	122.60	125.94
2	A	782	PGD	N19-C19-N20	2.24	119.39	116.49
2	A	782	PGD	C5-C4-N9	2.22	110.37	107.16
2	A	783	PGD	O4'-C1'-C2'	-2.20	103.40	106.77
5	A	786	DMS	O-S-C1	-2.18	94.59	106.62
2	A	782	PGD	C4'-O4'-C1'	-2.15	107.42	109.75

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	773/823 (93%)	-0.21	10 (1%) 74 75	6, 14, 27, 55	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	394	ALA	8.1
1	A	384	LYS	5.5
1	A	385	GLY	3.9
1	A	380	GLY	3.3
1	A	379	GLY	3.3
1	A	3	LEU	2.9
1	A	390	ALA	2.6
1	A	386	PRO	2.5
1	A	768	ALA	2.3
1	A	547	LYS	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(\AA^2)	Q<0.9
5	DMS	A	786	4/4	0.12	1.25	12,16,18,20	0
2	PGD	A	782	47/47	0.09	0.57	6,7,9,10	0
2	PGD	A	783	47/47	0.09	0.06	4,8,9,12	0
4	O	A	785	1/1	0.08	-0.68	19,19,19,19	0
3	4MO	A	784	1/1	0.03	-7.32	13,13,13,13	0

6.5 Other polymers

There are no such residues in this entry.