



Full wwPDB X-ray Structure Validation Report ⓘ

Sep 13, 2020 – 11:51 AM BST

PDB ID : 3LG1
Title : Structure of the Thioalkalivibrio nitratreducens cytochrome c nitrite reductase reduced by sodium borohydride (in complex with sulfite)
Authors : Trofimov, A.A.; Polyakov, K.M.; Boyko, K.M.; Filimonenkov, A.A.; Dorovatsky, P.V.; Tikhonova, T.V.; Popov, V.O.
Deposited on : 2010-01-19
Resolution : 1.95 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 ⓘ symbol.

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

MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	FAILED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.14.4.dev1

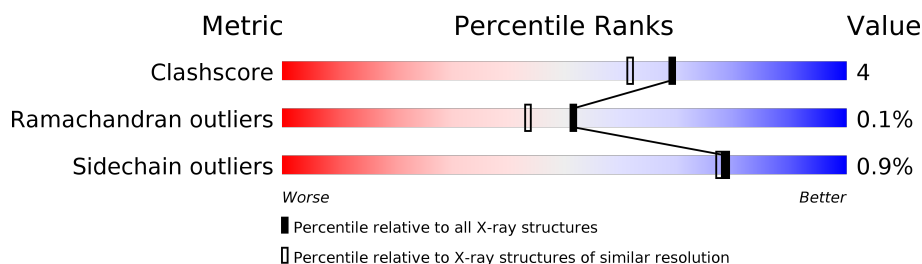
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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	141614	2705 (1.96-1.96)
Ramachandran outliers	138981	2678 (1.96-1.96)
Sidechain outliers	138945	2678 (1.96-1.96)

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 ≥ 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 $\leq 5\%$.

Note EDS failed to run properly.

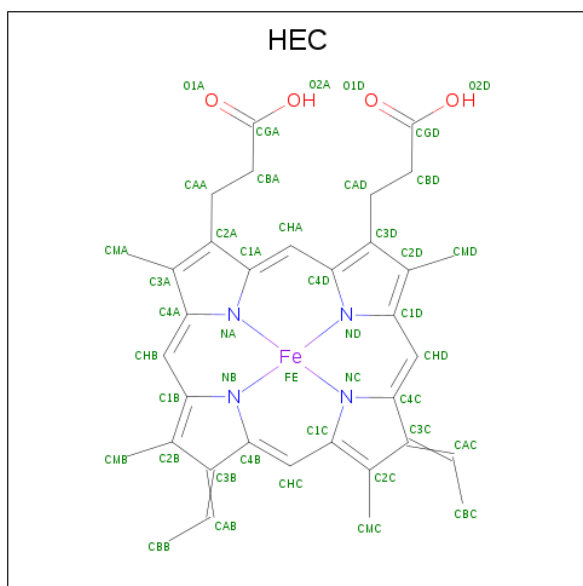
Mol	Chain	Length	Quality of chain
1	A	525	 94% 5% •
1	B	525	 93% 5% ••

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 Eight-heme nitrite reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	519	Total 4127	C 2565	N 745	O 780	S 37	0	10	1
1	B	519	Total 4159	C 2579	N 758	O 784	S 38	0	12	0

- Molecule 2 is HEME C (three-letter code: HEC) (formula: $\text{C}_{34}\text{H}_{34}\text{FeN}_4\text{O}_4$).



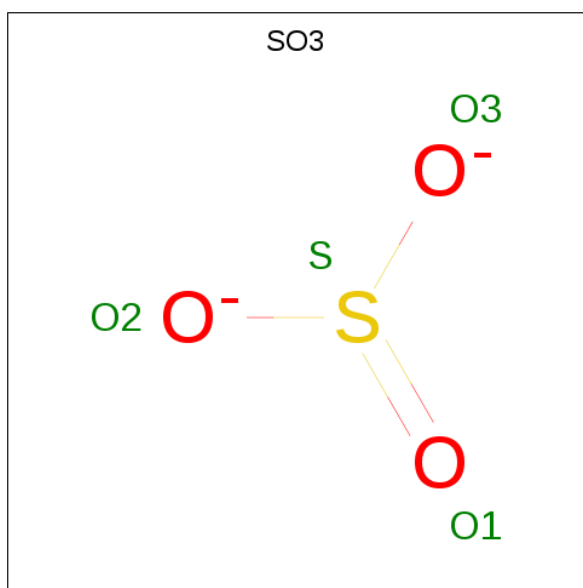
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	1

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	A	1	Total	C	Fe	N	O	0	1
			43	34	1	4	4		
2	A	1	Total	C	Fe	N	O	0	1
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	1
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	1
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 3 is SULFITE ION (three-letter code: SO3) (formula: O₃S).



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

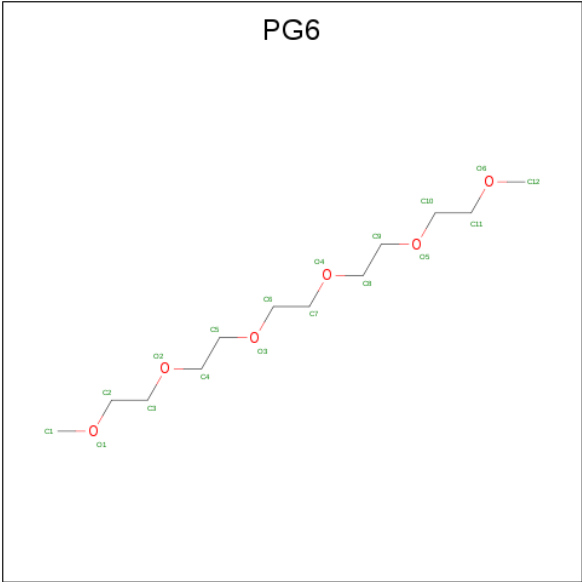
- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	2	Total Ca 2 2	0	0
4	A	2	Total Ca 2 2	0	0

- Molecule 5 is SODIUM ION (three-letter code: NA) (formula: Na).

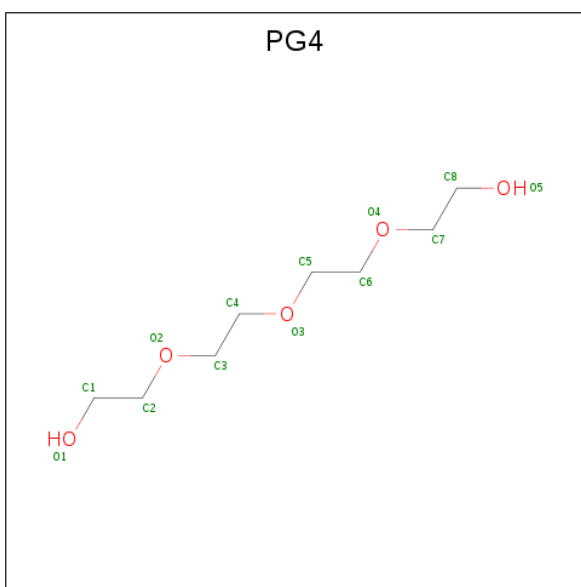
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	3	Total Na 3 3	0	0
5	A	5	Total Na 5 5	0	0

- Molecule 6 is 1-(2-METHOXY-ETHOXY)-2-{2-[2-(2-METHOXY-ETHOXY)-ETHOXY]-ETHANE (three-letter code: PG6) (formula: C₁₂H₂₆O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			17	11	6		
6	A	1	Total	C	O	0	0
			8	5	3		
6	A	1	Total	C	O	0	0
			7	4	3		
6	A	1	Total	C	O	0	0
			16	10	6		
6	A	1	Total	C	O	0	0
			10	6	4		
6	A	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			17	11	6		
6	B	1	Total	C	O	0	0
			10	6	4		
6	B	1	Total	C	O	0	1
			10	6	4		
6	B	1	Total	C	O	0	0
			8	5	3		
6	B	1	Total	C	O	0	0
			14	9	5		
6	B	1	Total	C	O	0	0
			10	6	4		

- Molecule 7 is TETRAETHYLENE GLYCOL (three-letter code: PG4) (formula: C₈H₁₈O₅).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			4	3	1		
7	A	1	Total	C	O	0	0
			6	4	2		
7	A	1	Total	C	O	0	0
			9	6	3		
7	A	1	Total	C	O	0	0
			5	3	2		
7	A	1	Total	C	O	0	0
			7	5	2		
7	A	1	Total	C	O	0	0
			6	4	2		
7	B	1	Total	C	O	0	0
			5	3	2		
7	B	1	Total	C	O	0	0
			6	4	2		
7	B	1	Total	C	O	0	0
			8	6	2		
7	B	1	Total	C	O	0	0
			5	3	2		

- Molecule 8 is water.


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	503	Total	O	0	0
			503	503		
8	B	471	Total	O	0	0
			471	471		

3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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. 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. 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.

Note EDS failed to run properly.

- Molecule 1: Eight-heme nitrite reductase

Chain A:  94% 5% •



- Molecule 1: Eight-heme nitrite reductase

Chain B:  93% 5% ••



4 Data and refinement statistics

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 3	Depositor
Cell constants a, b, c, α , β , γ	192.62Å 192.62Å 192.62Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.90 – 1.95	Depositor
% Data completeness (in resolution range)	99.7 (19.90-1.95)	Depositor
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.84 (at 1.90Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.161 , 0.183	Depositor
Wilson B-factor (Å ²)	19.9	Xtriage
Anisotropy	0.000	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.043 for l,-k,h	Xtriage
Total number of atoms	10172	wwPDB-VP
Average B, all atoms (Å ²)	21.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.86% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: NA, CA, SO3, PG6, PG4, HEC

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	0.75	0/4294	0.70	1/5825 (0.0%)
1	B	0.76	0/4340	0.71	0/5883
All	All	0.76	0/8634	0.71	1/11708 (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	A	161	ASP	CB-CG-OD1	5.50	123.25	118.30

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	4127	0	3834	17	0
1	B	4159	0	3875	21	0
2	A	344	0	160	5	0
2	B	344	0	188	9	0
3	A	8	0	0	1	0
3	B	12	0	0	0	0
4	A	2	0	0	0	0
4	B	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	5	0	0	0	0
5	B	3	0	0	0	0
6	A	62	0	73	1	0
6	B	69	0	71	5	0
7	A	37	0	38	3	0
7	B	24	0	24	5	0
8	A	503	0	0	6	0
8	B	471	0	0	6	0
All	All	10172	0	8263	59	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 (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:A:222[B]:ASN:ND2	8:A:876:HOH:O	1.85	1.08
1:B:222[A]:ASN:ND2	8:B:892:HOH:O	1.91	1.02
7:B:537:PG4:C1	7:B:537:PG4:C4	2.49	0.91
1:B:51[A]:ARG:HH11	1:B:51[A]:ARG:HG3	1.38	0.85
7:B:532:PG4:C4	8:B:704:HOH:O	2.31	0.78
7:B:537:PG4:H11	7:B:537:PG4:C4	2.14	0.77
2:A:1002:HEC:HMC1	2:A:1002:HEC:HBC3	1.68	0.75
7:B:532:PG4:H42	8:B:704:HOH:O	1.87	0.73
2:B:1002:HEC:HBC3	2:B:1002:HEC:HMC1	1.73	0.70
1:B:51[A]:ARG:NH1	1:B:51[A]:ARG:HG3	2.05	0.66
7:B:537:PG4:C4	7:B:537:PG4:H12	2.28	0.63
1:B:167:SER:HB2	1:B:216:GLU:HG2	1.83	0.59
2:A:1008:HEC:HMB1	2:A:1008:HEC:HBB3	1.86	0.58
2:B:1008:HEC:HMB1	2:B:1008:HEC:HBB3	1.86	0.57
1:B:60:ARG:HH22	6:B:539:PG6:H31	1.68	0.57
2:B:1008:HEC:HBC3	2:B:1008:HEC:HMC1	1.86	0.57
1:A:108:GLY:HA3	6:A:544:PG6:H31	1.86	0.57
6:B:531:PG6:H111	8:B:896:HOH:O	2.05	0.56
1:A:167:SER:HB2	1:A:216:GLU:HG2	1.88	0.55
1:A:68:THR:HG23	8:A:816:HOH:O	2.07	0.55
1:A:394[B]:VAL:HG12	8:A:1036:HOH:O	2.10	0.51
1:B:56[A]:ARG:NH2	1:B:195:ASP:OD1	2.36	0.51
1:B:51[A]:ARG:CG	1:B:51[A]:ARG:NH1	2.73	0.51
1:A:61[A]:MET:SD	1:A:191:ASP:O	2.70	0.50
6:B:534:PG6:O4	6:B:534:PG6:C5	2.60	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:1004:HEC:HBB3	2:A:1004:HEC:HMB1	1.93	0.49
1:A:360:GLN:HB3	1:A:361:HIS:CE1	2.47	0.49
3:A:537:SO3:O2	8:A:938:HOH:O	0.48	0.48
1:A:487:SER:HB3	1:A:491:HIS:CE1	2.50	0.47
1:B:61[C]:MET:SD	8:B:748:HOH:O	2.61	0.47
1:A:216:GLU:HG3	8:A:968:HOH:O	2.15	0.46
2:B:1001:HEC:HBC3	2:B:1001:HEC:HMC1	1.96	0.46
6:B:534:PG6:O4	6:B:534:PG6:H52	2.15	0.46
1:A:174:SER:HA	7:A:538:PG4:H11	1.98	0.46
7:A:546:PG4:H32	7:A:546:PG4:H12	1.39	0.46
1:B:487:SER:HB3	1:B:491:HIS:CE1	2.52	0.44
1:B:360:GLN:HB3	1:B:361:HIS:CE1	2.53	0.43
1:B:140:LYS:HG2	1:B:160:THR:HG23	1.99	0.43
1:B:430:ILE:HG21	1:B:490:PHE:HA	1.99	0.43
1:B:34:ASN:HA	6:B:534:PG6:H21	2.01	0.42
1:A:119:HIS:CD2	2:A:1006:HEC:ND	2.88	0.42
1:B:301:VAL:HG21	1:B:327:PHE:CE2	2.55	0.42
1:A:63:LEU:HD12	1:A:63:LEU:N	2.35	0.42
1:B:78:VAL:HG12	1:B:152:VAL:HG21	2.02	0.42
7:A:533:PG4:C4	8:A:687:HOH:O	2.69	0.41
1:B:479:TRP:CZ3	1:B:480:GLU:HG3	2.55	0.41
1:A:304:ASN:HB2	1:A:326:HIS:HB3	2.01	0.41
2:B:1002:HEC:HBD2	2:B:1002:HEC:HHA	2.03	0.41
1:B:119:HIS:CD2	2:B:1006:HEC:ND	2.89	0.41
1:A:61[A]:MET:HG2	1:A:228:PHE:CZ	2.56	0.41
2:B:1006:HEC:HMA3	2:B:1007[A]:HEC:HBA2	2.02	0.41
1:B:63:LEU:HD12	1:B:63:LEU:N	2.36	0.41
1:A:140:LYS:HG2	1:A:160:THR:HG23	2.02	0.40
2:B:1001:HEC:HMB1	2:B:1001:HEC:HBB3	2.02	0.40
1:B:305:CYS:CB	2:B:1004:HEC:HMC2	2.52	0.40
1:B:465:LEU:O	1:B:469:ARG:HG3	2.21	0.40
1:A:129:VAL:HG11	2:A:1004:HEC:HMA1	2.03	0.40
1:B:348[A]:ARG:NH1	8:B:807:HOH:O	2.45	0.40
1:A:374:ARG:NE	1:A:374:ARG:HA	2.37	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	528/525 (101%)	503 (95%)	25 (5%)	0	100	100
1	B	530/525 (101%)	503 (95%)	26 (5%)	1 (0%)	47	38
All	All	1058/1050 (101%)	1006 (95%)	51 (5%)	1 (0%)	51	43

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	361	HIS

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	442/443 (100%)	438 (99%)	4 (1%)	78	77
1	B	449/443 (101%)	439 (98%)	10 (2%)	52	44
All	All	891/886 (101%)	877 (98%)	14 (2%)	78	58

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	68	THR
1	A	220	ASP
1	A	406[A]	MET
1	A	406[B]	MET
1	B	19[A]	THR

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Mol	Chain	Res	Type
1	B	19[B]	THR
1	B	51[A]	ARG
1	B	51[B]	ARG
1	B	61[A]	MET
1	B	61[B]	MET
1	B	61[C]	MET
1	B	406[A]	MET
1	B	406[B]	MET
1	B	480	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	388	GLN

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 55 ligands modelled in this entry, 12 are monoatomic - leaving 43 for Mogul analysis.

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.

No monomer is involved in short contacts.

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 ⓘ

EDS failed to run properly - this section is therefore empty.

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

EDS failed to run properly - this section is therefore empty.

6.3 Carbohydrates ⓘ

EDS failed to run properly - this section is therefore empty.

6.4 Ligands ⓘ

EDS failed to run properly - this section is therefore empty.

6.5 Other polymers ⓘ

EDS failed to run properly - this section is therefore empty.