



## Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 05:13 PM UTC

PDB ID : 2WTH / pdb\_00002wth  
Title : Low resolution 3D structure of C.elegans globin-like protein (GLB-1): P3121 crystal form  
Authors : Geuens, E.; Hoogewijs, D.; Nardini, M.; Vinck, E.; Pesce, A.; Kiger, L.; Fago, A.; Tilleman, L.; De Henau, S.; Marden, M.; Weber, R.E.; Van Doorslaer, S.; Vanfleteren, J.; Moens, L.; Bolognesi, M.; Dewilde, S.  
Deposited on : 2009-09-16  
Resolution : 2.80 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

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

---

The following versions of software and data (see [references](#) ①) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Buster-report : wwPDB partial adaption of 1.1.7 (2018)  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

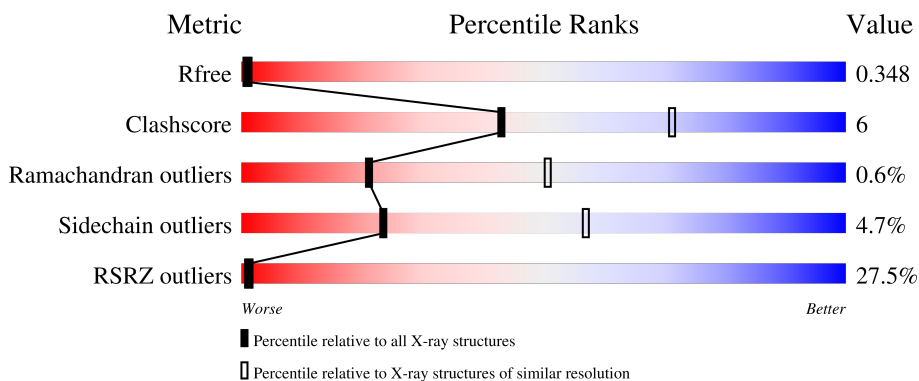
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.80 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))
$R_{free}$	180053	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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 of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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  $\leq 5\%$ . 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	159	
1	B	159	

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 2775 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.

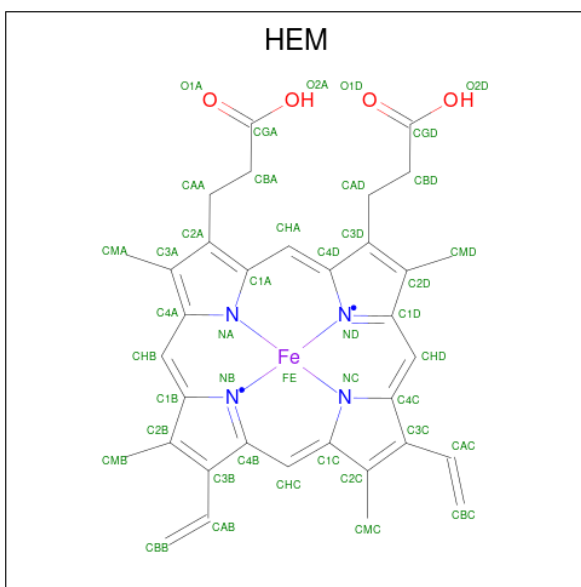
- Molecule 1 is a protein called GLOBIN-LIKE PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	158	Total	C	N	O	S	69	0	0
			1294	822	225	240	7			
1	B	158	Total	C	N	O	S	55	0	0
			1294	822	225	240	7			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	127	SER	CYS	engineered mutation	UNP P30627
B	127	SER	CYS	engineered mutation	UNP P30627

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula:  $C_{34}H_{32}FeN_4O_4$ ).



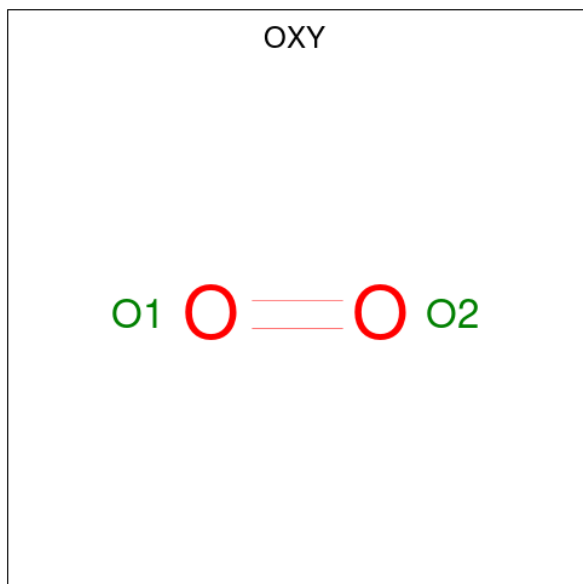
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Fe	N	O		
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

*Continued on next page...*

*Continued from previous page...*

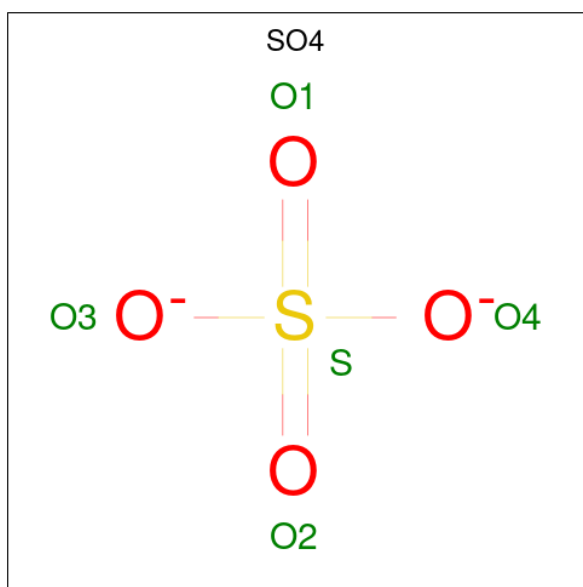
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Fe	N			O
2	B	1	43	34	1	4	4	0	0

- Molecule 3 is OXYGEN MOLECULE (CCD ID: OXY) (formula: O<sub>2</sub>).



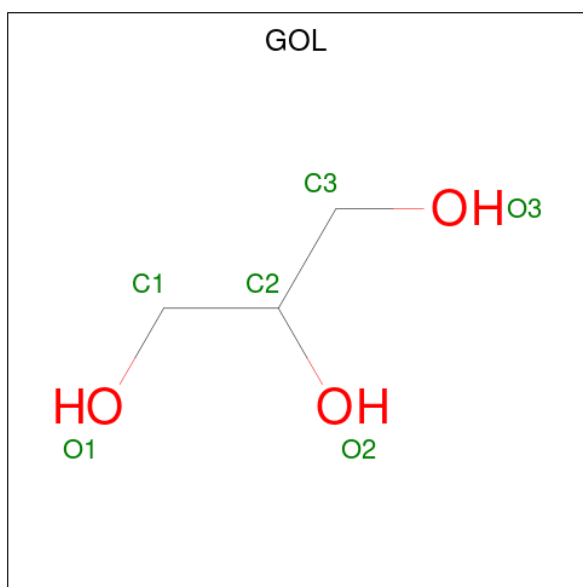
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total O 2 2	0	0
3	B	1	Total O 2 2	0	0

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O<sub>4</sub>S).



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

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



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

*Continued on next page...*

*Continued from previous page...*

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

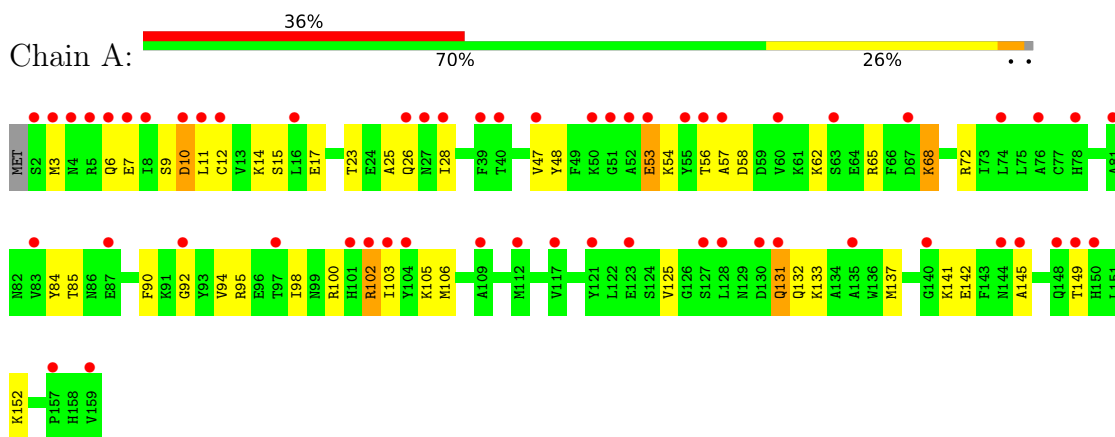
- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	21	Total O 21 21	0	0
6	B	25	Total O 25 25	0	0

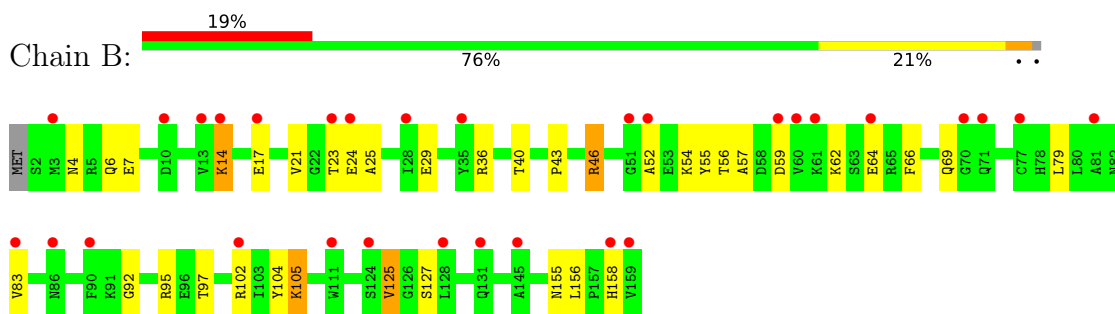
### 3 Residue-property plots [i](#)

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 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: GLOBIN-LIKE PROTEIN



- Molecule 1: GLOBIN-LIKE PROTEIN



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	77.68Å 77.68Å 145.64Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	34.28 – 2.80 34.28 – 2.80	Depositor EDS
% Data completeness (in resolution range)	97.8 (34.28-2.80) 96.5 (34.28-2.80)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	6.11 (at 2.81Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.269 , 0.319 0.297 , 0.348	Depositor DCC
$R_{free}$ test set	619 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	51.4	Xtrriage
Anisotropy	0.428	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 34.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.040 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.86	EDS
Total number of atoms	2775	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	60.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.49% 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, 0.333 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: HEM, SO4, OXY, 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	1.70	16/1323 (1.2%)	1.31	18/1780 (1.0%)
1	B	1.20	9/1323 (0.7%)	1.10	10/1780 (0.6%)
All	All	1.47	25/2646 (0.9%)	1.21	28/3560 (0.8%)

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	2	0
1	B	1	1
All	All	3	1

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	62	LYS	CA-CB	36.11	2.02	1.53
1	B	24	GLU	CA-CB	-30.57	1.07	1.53
1	A	125	VAL	CA-CB	-22.67	1.23	1.54
1	A	26	GLN	CA-CB	-17.26	1.25	1.53
1	A	11	LEU	C-N	14.61	1.52	1.33
1	B	7	GLU	CA-CB	-13.65	1.32	1.53
1	A	28	ILE	CA-CB	-13.27	1.37	1.54
1	A	25	ALA	CA-CB	-12.55	1.33	1.53
1	A	152	LYS	CA-CB	-10.69	1.35	1.53
1	A	102	ARG	CB-CG	-10.01	1.22	1.52
1	A	105	LYS	CD-CE	9.73	1.81	1.52
1	B	54	LYS	CG-CD	-9.35	1.24	1.52
1	A	149	THR	CB-CG2	9.26	1.83	1.52
1	A	57	ALA	CA-CB	-8.53	1.39	1.53

*Continued on next page...*

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	125	VAL	CB-CG1	-8.29	1.25	1.52
1	A	100	ARG	CD-NE	8.07	1.57	1.46
1	B	23	THR	CB-CG2	7.99	1.78	1.52
1	A	132	GLN	CD-NE2	7.93	1.50	1.33
1	A	68	LYS	CA-CB	7.81	1.66	1.53
1	A	145	ALA	CA-CB	7.49	1.65	1.53
1	B	64	GLU	CB-CG	-7.39	1.30	1.52
1	B	62	LYS	CB-CG	-7.22	1.30	1.52
1	B	57	ALA	CA-CB	-7.09	1.42	1.53
1	B	155	ASN	CA-CB	-6.36	1.44	1.53
1	A	132	GLN	CD-OE1	5.69	1.34	1.23

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	152	LYS	N-CA-CB	15.82	134.79	110.28
1	A	62	LYS	CB-CA-C	-15.27	86.55	111.13
1	A	23	THR	OG1-CB-CG2	-14.07	81.17	109.30
1	B	125	VAL	CG1-CB-CG2	12.53	138.37	110.80
1	A	149	THR	OG1-CB-CG2	-11.55	86.19	109.30
1	A	25	ALA	N-CA-CB	11.43	126.97	109.94
1	B	25	ALA	N-CA-CB	9.48	124.06	110.12
1	B	7	GLU	N-CA-CB	9.03	123.11	110.01
1	A	152	LYS	CA-CB-CG	8.94	131.97	114.10
1	B	24	GLU	N-CA-CB	8.75	122.19	110.29
1	B	127	SER	CB-CA-C	-7.89	97.36	110.29
1	B	62	LYS	CA-CB-CG	7.61	129.31	114.10
1	A	149	THR	CA-CB-CG2	-7.58	97.62	110.50
1	A	125	VAL	N-CA-CB	6.88	122.59	111.23
1	B	24	GLU	CA-CB-CG	-6.82	100.47	114.10
1	A	125	VAL	CB-CA-C	6.73	122.33	111.29
1	B	14	LYS	N-CA-CB	6.46	119.38	110.01
1	A	125	VAL	CA-CB-CG2	-6.34	99.62	110.40
1	B	57	ALA	CB-CA-C	6.31	120.79	110.88
1	B	24	GLU	CB-CA-C	6.15	124.17	110.02
1	A	57	ALA	N-CA-CB	5.83	119.35	110.14
1	A	131	GLN	CB-CG-CD	-5.62	103.05	112.60
1	A	105	LYS	CG-CD-CE	-5.46	98.75	111.30
1	A	62	LYS	N-CA-CB	-5.43	102.26	111.17
1	A	102	ARG	CA-CB-CG	5.29	124.69	114.10
1	A	12	CYS	CA-C-N	5.21	127.31	120.60
1	A	12	CYS	C-N-CA	5.21	127.31	120.60

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	11	LEU	O-C-N	5.09	127.52	122.08

All (3) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	25	ALA	CA
1	A	125	VAL	CA
1	B	24	GLU	CA

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	102	ARG	Sidechain

## 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	1294	0	1253	13	1
1	B	1294	0	1253	15	0
2	A	43	0	30	2	0
2	B	43	0	30	2	0
3	A	2	0	0	0	0
3	B	2	0	0	0	0
4	A	5	0	0	0	0
4	B	10	0	0	0	0
5	A	12	0	16	3	0
5	B	24	0	32	2	1
6	A	21	0	0	0	0
6	B	25	0	0	0	0
All	All	2775	0	2614	31	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 6.

All (31) 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)
5:A:1162:GOL:O1	5:A:1162:GOL:C1	1.71	1.38
1:A:47:VAL:HA	1:A:53:GLU:HG2	1.72	0.71
5:A:1162:GOL:O1	5:A:1162:GOL:C2	2.45	0.65
1:B:52:ALA:HA	1:B:55:TYR:CD1	2.32	0.65
1:A:65:ARG:HH21	2:A:160:HEM:CGA	2.20	0.55
1:B:79:LEU:O	1:B:83:VAL:HG22	2.08	0.54
1:A:94:VAL:O	1:A:98:ILE:HG12	2.09	0.53
1:B:156:LEU:O	1:B:158:HIS:HD2	1.92	0.52
1:B:92:GLY:HA2	1:B:95:ARG:NH2	2.25	0.52
1:A:48:TYR:CE1	1:A:106:MET:HA	2.45	0.51
5:A:1162:GOL:C1	5:A:1162:GOL:HO1	2.14	0.50
1:A:90:PHE:O	1:A:94:VAL:HG23	2.11	0.50
1:B:46:ARG:NH1	1:B:55:TYR:O	2.45	0.50
1:B:56:THR:H	1:B:59:ASP:HB2	1.75	0.50
1:A:14:LYS:O	1:A:17:GLU:HG2	2.13	0.49
1:B:4:ASN:HD21	1:B:6:GLN:HB3	1.79	0.48
1:B:104:TYR:OH	2:B:160:HEM:HAA1	2.14	0.48
1:A:72:ARG:HH11	2:A:160:HEM:HBD1	1.80	0.47
1:B:43:PRO:HA	1:B:46:ARG:HD3	1.97	0.46
1:A:92:GLY:HA2	1:A:95:ARG:NH2	2.31	0.45
1:A:84:TYR:OH	1:A:142:GLU:HG3	2.17	0.45
1:B:14:LYS:O	1:B:17:GLU:HG2	2.17	0.45
1:A:133:LYS:O	1:A:137:MET:HG2	2.17	0.44
1:A:9:SER:O	1:A:10:ASP:C	2.61	0.44
1:A:6:GLN:HA	1:A:85:THR:HG22	2.01	0.43
1:B:66:PHE:HA	1:B:69:GLN:HB3	2.01	0.43
1:A:3:MET:HG2	1:A:7:GLU:OE1	2.19	0.42
1:B:97:THR:HG21	2:B:160:HEM:HAC	2.00	0.41
1:B:4:ASN:HB2	5:B:1161:GOL:O2	2.20	0.41
1:B:105:LYS:NZ	5:B:1162:GOL:H12	2.35	0.41
1:B:36:ARG:O	1:B:40:THR:OG1	2.30	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:141:LYS:NZ	5:B:1162:GOL:O3[4_655]	1.85	0.35

## 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	156/159 (98%)	146 (94%)	9 (6%)	1 (1%)	21	51
1	B	156/159 (98%)	148 (95%)	7 (4%)	1 (1%)	21	51
All	All	312/318 (98%)	294 (94%)	16 (5%)	2 (1%)	21	51

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	53	GLU
1	B	105	LYS

### 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	137/138 (99%)	128 (93%)	9 (7%)	15	43
1	B	137/138 (99%)	133 (97%)	4 (3%)	37	73
All	All	274/276 (99%)	261 (95%)	13 (5%)	23	57

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	ASP
1	A	15	SER
1	A	54	LYS
1	A	56	THR

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	A	58	ASP
1	A	68	LYS
1	A	102	ARG
1	A	103	ILE
1	A	131	GLN
1	B	21	VAL
1	B	29	GLU
1	B	46	ARG
1	B	125	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	4	ASN
1	B	41	ASN
1	B	153	ASN
1	B	158	HIS

### 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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

13 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	OXY	B	161	2	1,1,1	0.17	0	-		
5	GOL	A	1162	-	5,5,5	3.46	2 (40%)	5,5,5	1.49	1 (20%)
5	GOL	A	1161	-	5,5,5	0.41	0	5,5,5	0.19	0
4	SO4	A	1160	-	4,4,4	0.24	0	6,6,6	0.14	0
5	GOL	B	1165	-	5,5,5	0.36	0	5,5,5	0.31	0
5	GOL	B	1162	-	5,5,5	0.36	0	5,5,5	0.36	0
2	HEM	B	160	3,1	50,50,50	1.99	10 (20%)	67,82,82	1.29	4 (5%)
4	SO4	B	1160	-	4,4,4	0.24	0	6,6,6	0.13	0
5	GOL	B	1161	-	5,5,5	0.39	0	5,5,5	0.28	0
5	GOL	B	1164	-	5,5,5	0.70	0	5,5,5	0.59	0
4	SO4	B	1163	-	4,4,4	0.97	0	6,6,6	0.28	0
3	OXY	A	161	2	1,1,1	0.16	0	-		
2	HEM	A	160	3,1	50,50,50	1.98	9 (18%)	67,82,82	1.18	2 (2%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	GOL	A	1162	-	-	1/4/4/4	-
5	GOL	A	1161	-	-	2/4/4/4	-
5	GOL	B	1165	-	-	2/4/4/4	-
5	GOL	B	1162	-	-	2/4/4/4	-
2	HEM	B	160	3,1	-	5/14/54/54	-
5	GOL	B	1161	-	-	0/4/4/4	-
5	GOL	B	1164	-	-	4/4/4/4	-
2	HEM	A	160	3,1	-	9/14/54/54	-

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	160	HEM	C3D-C2D	8.27	1.54	1.36
2	B	160	HEM	C3D-C2D	8.07	1.54	1.36
5	A	1162	GOL	O1-C1	6.97	1.71	1.42
2	A	160	HEM	FE-NA	5.11	2.12	1.95
2	B	160	HEM	FE-NB	4.91	2.10	1.94

*Continued on next page...*

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	160	HEM	FE-NB	4.81	2.09	1.94
2	B	160	HEM	FE-NC	4.16	2.08	1.95
2	B	160	HEM	FE-ND	3.94	2.07	1.94
2	B	160	HEM	FE-NA	3.39	2.06	1.95
2	A	160	HEM	FE-ND	3.24	2.04	1.94
2	A	160	HEM	CAB-C3B	3.01	1.55	1.47
2	B	160	HEM	CAC-C3C	3.01	1.55	1.47
2	B	160	HEM	CAB-C3B	2.93	1.55	1.47
5	A	1162	GOL	O3-C3	2.90	1.54	1.42
2	A	160	HEM	CAC-C3C	2.86	1.55	1.47
2	A	160	HEM	CMA-C3A	2.20	1.55	1.50
2	A	160	HEM	CMC-C2C	2.15	1.55	1.50
2	A	160	HEM	CMB-C2B	2.14	1.55	1.50
2	B	160	HEM	CMA-C3A	2.12	1.55	1.50
2	B	160	HEM	CMB-C2B	2.06	1.55	1.50
2	B	160	HEM	CMC-C2C	2.03	1.54	1.50

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	160	HEM	C4D-ND-C1D	5.43	111.64	105.21
2	A	160	HEM	C4D-ND-C1D	5.35	111.55	105.21
5	A	1162	GOL	O1-C1-C2	-3.06	96.59	110.38
2	B	160	HEM	CAD-C3D-C4D	2.18	128.50	124.70
2	B	160	HEM	CHD-C1D-ND	2.16	126.75	124.42
2	B	160	HEM	C2A-C1A-NA	-2.16	107.75	110.15
2	A	160	HEM	C3B-C2B-C1B	2.14	108.02	106.41

There are no chirality outliers.

All (25) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	160	HEM	C2B-C3B-CAB-CBB
2	A	160	HEM	C2C-C3C-CAC-CBC
2	A	160	HEM	C2D-C3D-CAD-CBD
2	A	160	HEM	C4D-C3D-CAD-CBD
2	B	160	HEM	C2C-C3C-CAC-CBC
2	B	160	HEM	C4C-C3C-CAC-CBC
5	A	1161	GOL	O1-C1-C2-C3
5	B	1162	GOL	C1-C2-C3-O3
5	B	1164	GOL	O1-C1-C2-C3
5	B	1164	GOL	C1-C2-C3-O3

Continued on next page...

*Continued from previous page...*

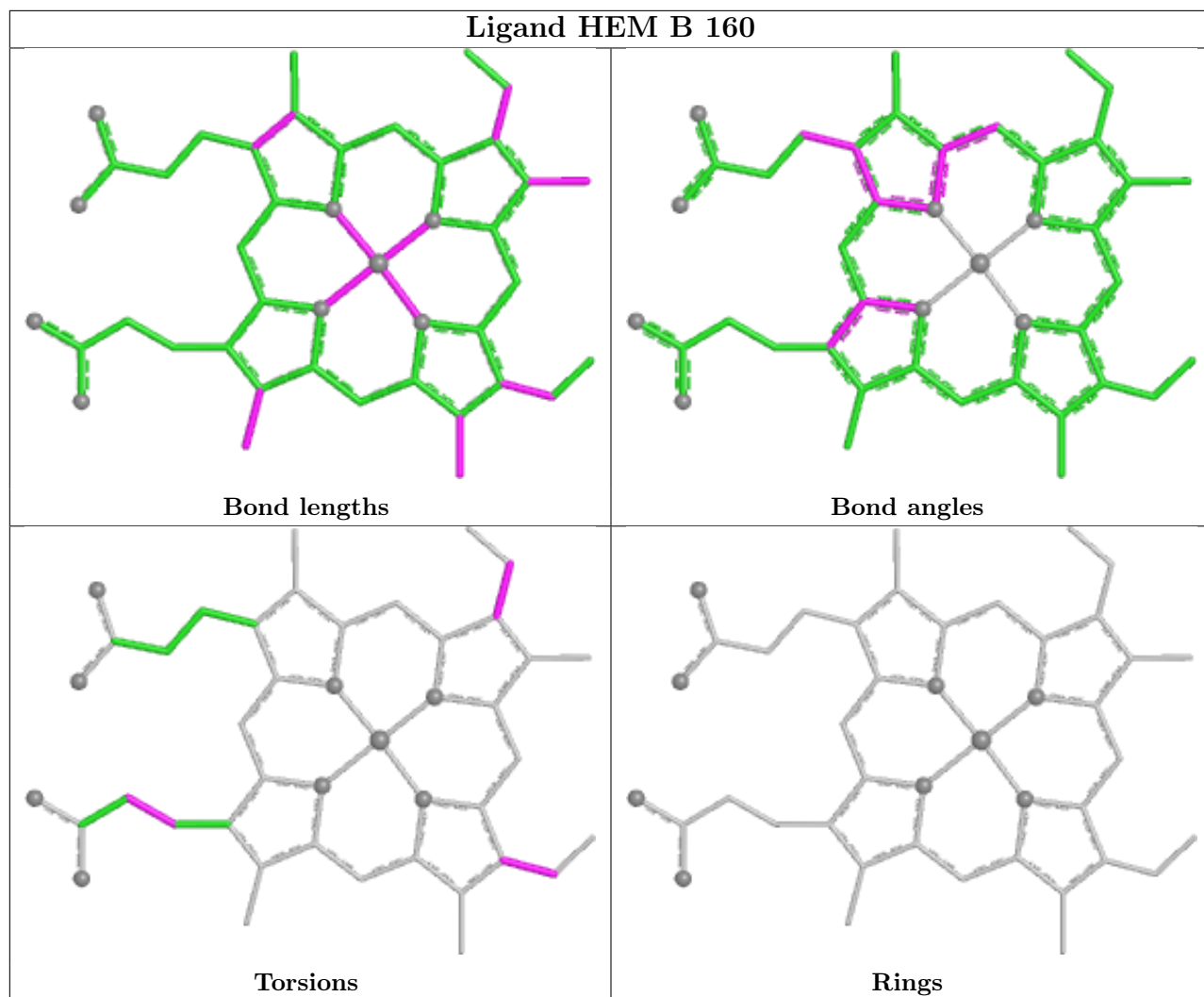
Mol	Chain	Res	Type	Atoms
2	B	160	HEM	C2A-CAA-CBA-CGA
5	B	1162	GOL	O2-C2-C3-O3
5	B	1165	GOL	C1-C2-C3-O3
5	A	1161	GOL	O1-C1-C2-O2
5	B	1164	GOL	O1-C1-C2-O2
5	B	1164	GOL	O2-C2-C3-O3
2	A	160	HEM	C4B-C3B-CAB-CBB
2	A	160	HEM	C4C-C3C-CAC-CBC
5	B	1165	GOL	O2-C2-C3-O3
2	B	160	HEM	C2B-C3B-CAB-CBB
2	A	160	HEM	CAA-CBA-CGA-O2A
2	A	160	HEM	CAA-CBA-CGA-O1A
2	B	160	HEM	C4B-C3B-CAB-CBB
5	A	1162	GOL	O2-C2-C3-O3
2	A	160	HEM	CAD-CBD-CGD-O2D

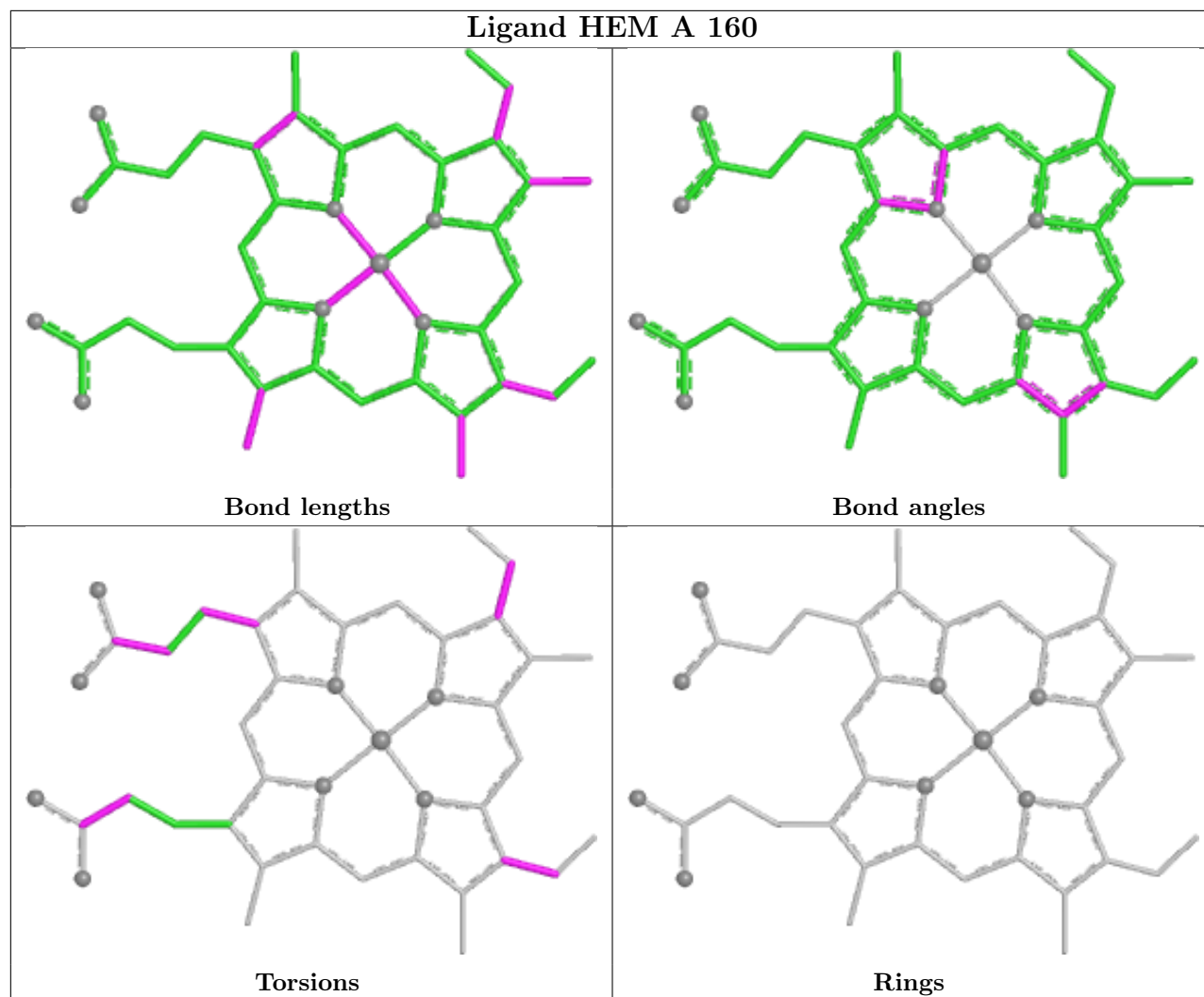
There are no ring outliers.

5 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	1162	GOL	3	0
5	B	1162	GOL	1	1
2	B	160	HEM	2	0
5	B	1161	GOL	1	0
2	A	160	HEM	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





## 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	158/159 (99%)	1.74	57 (36%) <b>1</b> <b>0</b>	27, 58, 73, 80	21 (13%)
1	B	158/159 (99%)	1.41	30 (18%) <b>3</b> <b>2</b>	25, 57, 71, 73	17 (10%)
All	All	316/318 (99%)	1.57	87 (27%) <b>1</b> <b>1</b>	25, 57, 73, 80	38 (12%)

All (87) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	10	ASP	4.5
1	A	4	ASN	4.5
1	A	51	GLY	4.1
1	A	131	GLN	4.1
1	A	157	PRO	3.9
1	A	47	VAL	3.8
1	B	158	HIS	3.8
1	A	150	HIS	3.6
1	B	24	GLU	3.4
1	B	131	GLN	3.4
1	A	78	HIS	3.3
1	A	135	ALA	3.3
1	A	81	ALA	3.2
1	A	102	ARG	3.2
1	A	5	ARG	3.2
1	A	16	LEU	3.1
1	A	127	SER	3.1
1	A	27	ASN	3.1
1	B	23	THR	3.0
1	A	63	SER	3.0
1	A	39	PHE	3.0
1	B	102	ARG	3.0
1	A	6	GLN	2.9
1	B	52	ALA	2.9

*Continued on next page...*

*Continued from previous page...*

<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	B	64	GLU	2.9
1	A	83	VAL	2.9
1	B	145	ALA	2.9
1	B	60	VAL	2.8
1	B	71	GLN	2.8
1	A	87	GLU	2.8
1	A	67	ASP	2.7
1	A	92	GLY	2.7
1	B	51	GLY	2.7
1	B	17	GLU	2.7
1	A	52	ALA	2.7
1	A	145	ALA	2.7
1	B	90	PHE	2.7
1	A	7	GLU	2.7
1	A	140	GLY	2.6
1	A	56	THR	2.6
1	A	130	ASP	2.6
1	A	101	HIS	2.6
1	A	8	ILE	2.6
1	A	109	ALA	2.6
1	A	144	ASN	2.6
1	A	10	ASP	2.6
1	A	2	SER	2.5
1	A	60	VAL	2.5
1	B	83	VAL	2.5
1	B	124	SER	2.5
1	A	26	GLN	2.5
1	A	57	ALA	2.4
1	B	128	LEU	2.4
1	B	159	VAL	2.4
1	B	28	ILE	2.4
1	A	3	MET	2.4
1	B	3	MET	2.4
1	B	86	ASN	2.4
1	A	50	LYS	2.4
1	A	55	TYR	2.4
1	A	76	ALA	2.3
1	A	123	GLU	2.2
1	A	128	LEU	2.2
1	A	40	THR	2.2
1	A	149	THR	2.2
1	A	117	VAL	2.2

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	A	28	ILE	2.2
1	B	35	TYR	2.2
1	B	70	GLY	2.2
1	A	104	TYR	2.2
1	B	81	ALA	2.2
1	A	148	GLN	2.2
1	A	159	VAL	2.2
1	B	111	TRP	2.2
1	A	53	GLU	2.2
1	B	14	LYS	2.1
1	A	121	TYR	2.1
1	A	97	THR	2.1
1	A	112	MET	2.0
1	B	77	CYS	2.0
1	A	11	LEU	2.0
1	A	103	ILE	2.0
1	B	61	LYS	2.0
1	A	12	CYS	2.0
1	A	74	LEU	2.0
1	B	59	ASP	2.0
1	B	13	VAL	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 oligosaccharides 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, 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.

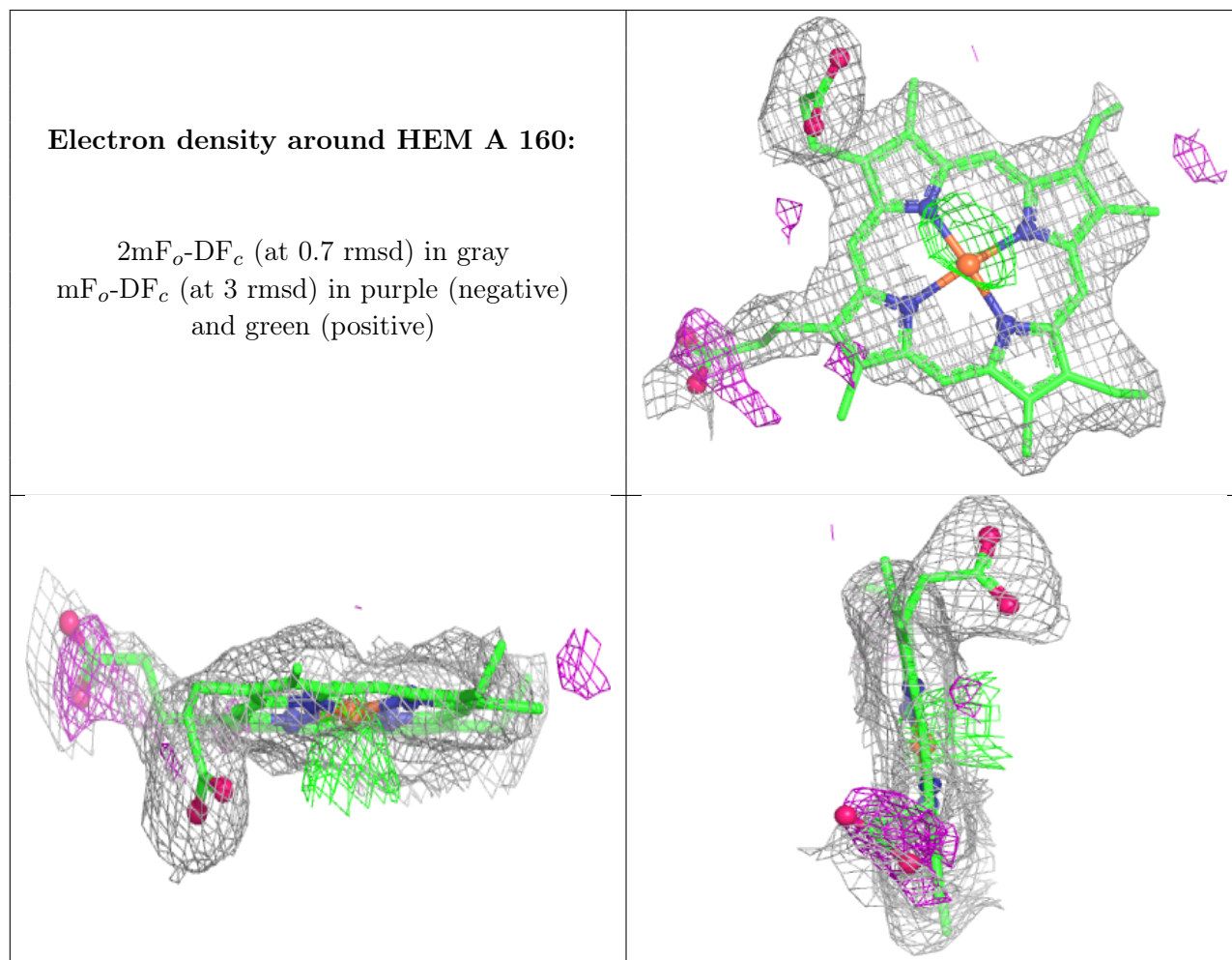
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
5	GOL	A	1162	6/6	0.53	0.28	52,52,52,52	0
5	GOL	B	1164	6/6	0.69	0.16	76,77,77,77	0

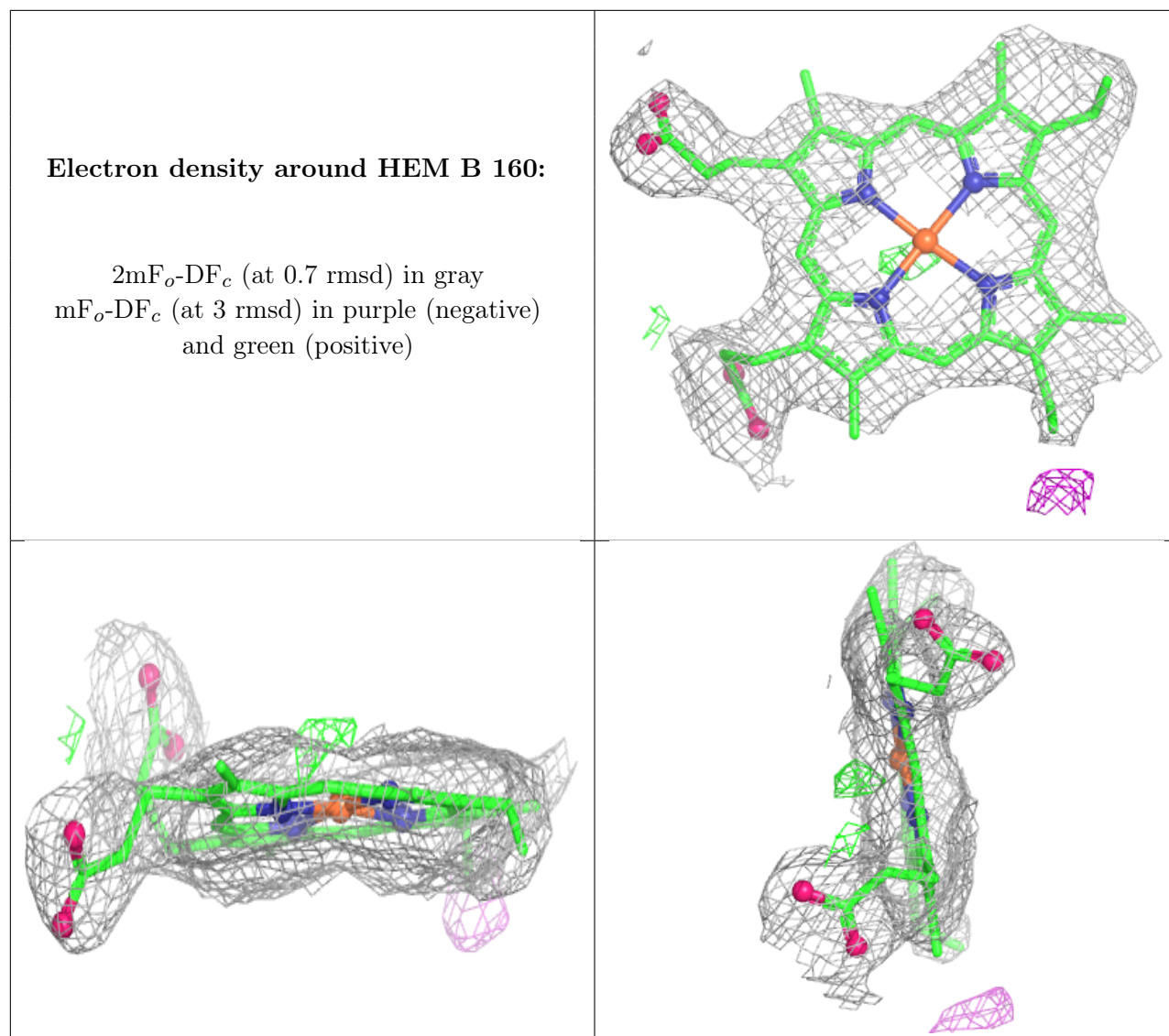
*Continued on next page...*

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
4	SO4	B	1163	5/5	0.70	0.23	61,61,61,61	0
5	GOL	B	1161	6/6	0.75	0.20	70,70,70,71	0
4	SO4	A	1160	5/5	0.75	0.31	64,65,65,65	0
5	GOL	B	1162	6/6	0.76	0.14	61,62,62,62	0
5	GOL	A	1161	6/6	0.80	0.17	55,56,56,56	0
5	GOL	B	1165	6/6	0.80	0.11	61,61,62,62	0
4	SO4	B	1160	5/5	0.82	0.18	62,62,62,62	0
3	OXY	B	161	2/2	0.90	0.20	64,64,64,65	0
2	HEM	A	160	43/43	0.93	0.15	51,52,58,63	0
2	HEM	B	160	43/43	0.95	0.13	48,53,59,60	0
3	OXY	A	161	2/2	0.95	0.15	65,65,65,66	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.





## 6.5 Other polymers [i](#)

There are no such residues in this entry.