



Full wwPDB X-ray Structure Validation Report ⓘ

May 7, 2026 – 08:25 AM EDT

PDB ID : 3BCQ / pdb_00003bcq
Title : Crystal structure of oxy-hemoglobin from Brycon cephalus
Authors : Poy, C.D.; Leopoldino, A.M.; Rahal, P.; de Azevedo, W.F.; Rodriguez, G.O.B.; Murakami, M.T.
Deposited on : 2007-11-13
Resolution : 2.40 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 types of validation reports are described at

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

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

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (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

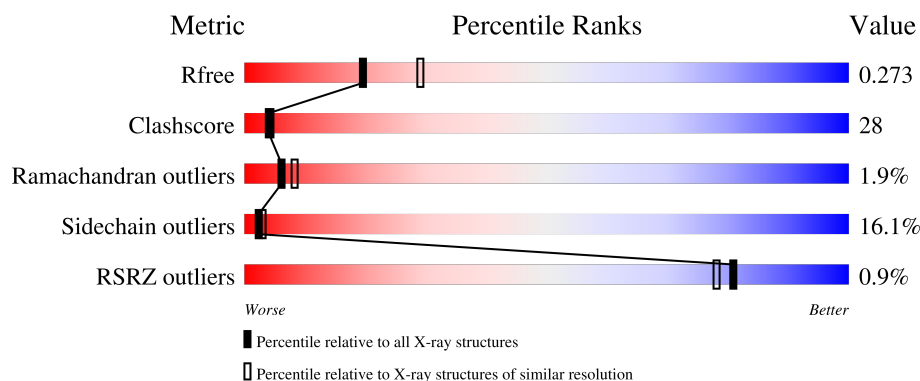
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	4912 (2.40-2.40)
Clashscore	190562	5391 (2.40-2.40)
Ramachandran outliers	187476	5320 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)
RSRZ outliers	180081	4916 (2.40-2.40)

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 ≥ 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	142	
1	C	142	
2	B	146	
2	D	146	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	OXY	A	144	-	-	X	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 4772 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 Alpha-chain hemoglobin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	142	Total	C	N	O	S	0	1	0
			1124	725	187	209	3			
1	C	142	Total	C	N	O	S	0	2	0
			1128	729	186	210	3			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	9	SER	ALA	SEE REMARK 999	UNP A1YZP4
A	32	MET	THR	SEE REMARK 999	UNP A1YZP4
A	65	GLY	SER	SEE REMARK 999	UNP A1YZP4
A	66	SER	GLY	SEE REMARK 999	UNP A1YZP4
A	112	GLN	ILE	SEE REMARK 999	UNP A1YZP4
A	132	LEU	ALA	SEE REMARK 999	UNP A1YZP4
A	134	SER	ALA	SEE REMARK 999	UNP A1YZP4
A	135	TRP	LEU	SEE REMARK 999	UNP A1YZP4
A	136	SER	ALA	SEE REMARK 999	UNP A1YZP4
C	9	SER	ALA	SEE REMARK 999	UNP A1YZP4
C	32	MET	THR	SEE REMARK 999	UNP A1YZP4
C	65	GLY	SER	SEE REMARK 999	UNP A1YZP4
C	66	SER	GLY	SEE REMARK 999	UNP A1YZP4
C	112	GLN	ILE	SEE REMARK 999	UNP A1YZP4
C	132	LEU	ALA	SEE REMARK 999	UNP A1YZP4
C	134	SER	ALA	SEE REMARK 999	UNP A1YZP4
C	135	TRP	LEU	SEE REMARK 999	UNP A1YZP4
C	136	SER	ALA	SEE REMARK 999	UNP A1YZP4

- Molecule 2 is a protein called Beta-chain hemoglobin.

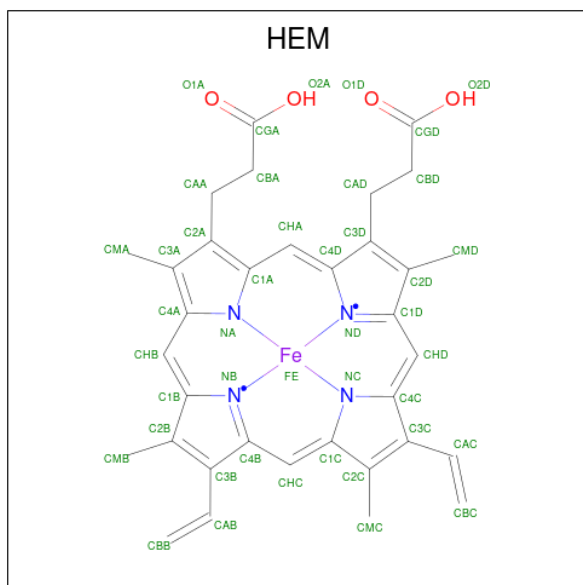
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	146	Total	C	N	O	S	0	0	0
			1125	721	198	200	6			

Continued on next page...

Continued from previous page...

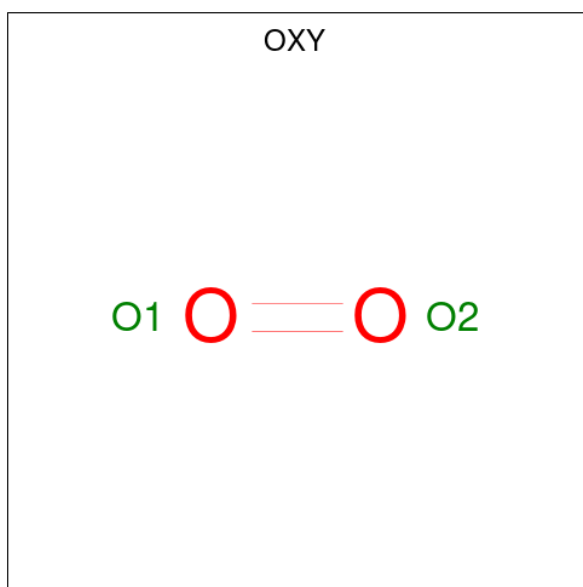
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	146	Total	C	N	O	S	0	0	0
			1125	721	198	200	6			

- Molecule 3 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



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

- Molecule 4 is OXYGEN MOLECULE (CCD ID: OXY) (formula: O_2).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total O 2 2	0	0
4	B	1	Total O 2 2	0	0
4	C	1	Total O 2 2	0	0
4	D	1	Total O 2 2	0	0

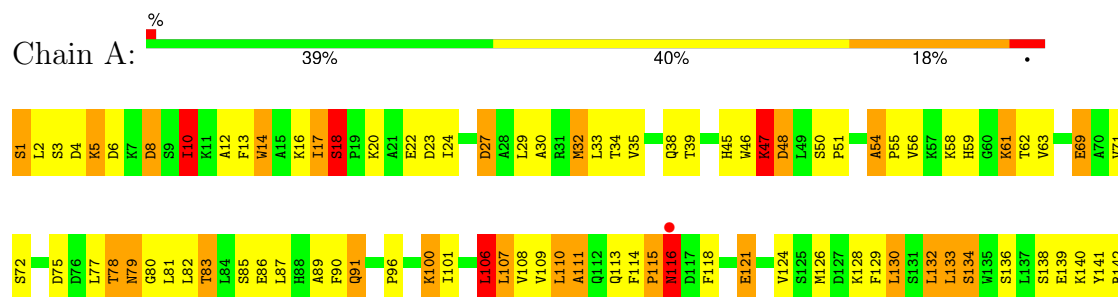
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	31	Total O 31 31	0	0
5	B	13	Total O 13 13	0	0
5	C	25	Total O 25 25	0	0
5	D	21	Total O 21 21	0	0

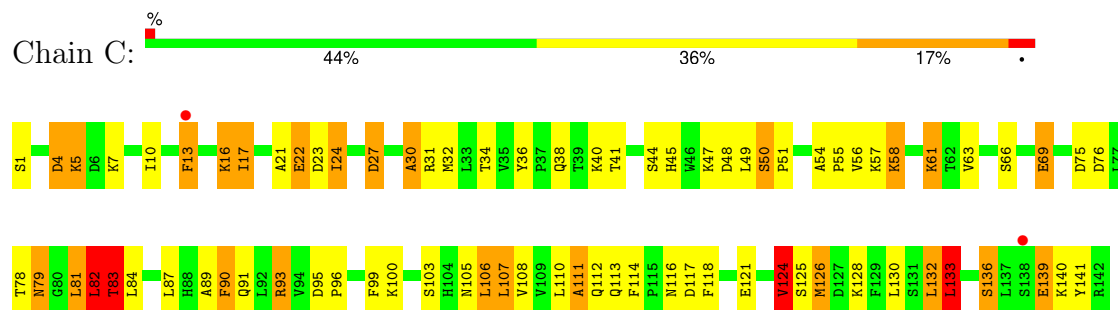
3 Residue-property plots [i](#)

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.

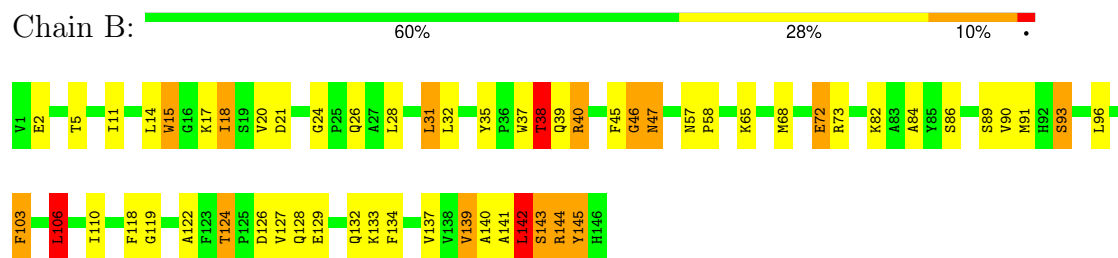
• Molecule 1: Alpha-chain hemoglobin



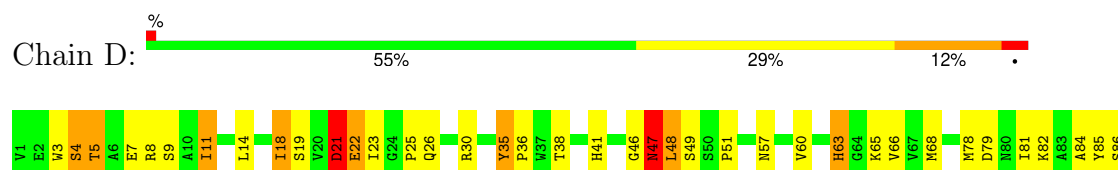
• Molecule 1: Alpha-chain hemoglobin



• Molecule 2: Beta-chain hemoglobin



• Molecule 2: Beta-chain hemoglobin





4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	119.37Å 54.04Å 101.91Å 90.00° 113.89° 90.00°	Depositor
Resolution (Å)	19.89 – 2.40 19.89 – 2.40	Depositor EDS
% Data completeness (in resolution range)	86.9 (19.89-2.40) 86.7 (19.89-2.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.61 (at 2.41Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.166 , 0.279 0.164 , 0.273	Depositor DCC
R_{free} test set	1042 reflections (4.45%)	wwPDB-VP
Wilson B-factor (Å ²)	40.4	Xtriage
Anisotropy	0.093	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 39.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4772	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.69% 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

5.1 Standard geometry

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

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	1.74	13/1154 (1.1%)	1.72	28/1561 (1.8%)
1	C	1.75	10/1161 (0.9%)	1.61	15/1572 (1.0%)
2	B	1.55	7/1154 (0.6%)	1.62	16/1567 (1.0%)
2	D	1.55	9/1154 (0.8%)	1.63	25/1567 (1.6%)
All	All	1.65	39/4623 (0.8%)	1.65	84/6267 (1.3%)

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	1	3
2	B	0	2
2	D	0	1
All	All	1	6

All (39) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	30	ALA	CA-CB	-11.45	1.34	1.53
2	B	18	ILE	CA-CB	8.85	1.64	1.53
1	C	83	THR	CA-CB	8.55	1.68	1.53
1	C	124	VAL	CA-CB	7.91	1.64	1.54
2	D	112	VAL	CA-CB	7.46	1.64	1.54
2	B	134	PHE	N-CA	-6.79	1.38	1.46
1	A	54	ALA	CA-CB	6.68	1.62	1.53
2	B	106	LEU	C-O	-6.61	1.16	1.24
1	C	111	ALA	C-O	-6.48	1.16	1.24
2	D	127	VAL	CA-CB	-6.36	1.46	1.54
2	D	63	HIS	CA-C	6.04	1.60	1.52

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	78	THR	CA-CB	-5.94	1.44	1.53
1	A	134	SER	N-CA	5.87	1.53	1.46
1	A	106	LEU	CB-CG	-5.69	1.42	1.53
1	C	136	SER	CA-CB	5.67	1.62	1.53
1	C	27	ASP	CB-CG	5.67	1.66	1.52
2	D	84	ALA	CA-C	5.66	1.60	1.52
2	B	128	GLN	CA-C	-5.66	1.45	1.52
1	C	4	ASP	CB-CG	5.62	1.66	1.52
2	D	116	MET	C-O	-5.53	1.17	1.24
2	B	5	THR	CA-CB	5.52	1.62	1.53
1	A	124	VAL	CA-CB	5.51	1.60	1.54
1	C	105	ASN	C-O	-5.49	1.17	1.24
1	A	27	ASP	CB-CG	5.49	1.65	1.52
1	A	106	LEU	CA-CB	-5.32	1.44	1.53
2	D	126	ASP	C-O	-5.32	1.18	1.24
1	A	10	ILE	CA-CB	5.31	1.61	1.54
2	D	137	VAL	C-O	-5.28	1.18	1.24
1	C	112	GLN	CD-NE2	-5.24	1.22	1.33
2	B	31	LEU	C-O	-5.24	1.18	1.24
1	A	12	ALA	CA-C	-5.20	1.45	1.52
1	A	47	LYS	N-CA	-5.18	1.39	1.46
1	A	35	VAL	CA-C	-5.16	1.45	1.52
1	A	14	TRP	N-CA	-5.14	1.40	1.46
2	D	129	GLU	N-CA	-5.13	1.40	1.46
2	B	39	GLN	C-O	-5.11	1.18	1.24
1	A	116	ASN	CA-CB	5.10	1.62	1.53
2	D	128	GLN	C-O	-5.04	1.18	1.24
1	A	33	LEU	C-O	-5.03	1.18	1.24

All (84) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	121	SER	N-CA-C	11.19	127.11	113.23
2	B	142	LEU	N-CA-C	11.07	125.52	111.24
1	A	106	LEU	CB-CG-CD2	-10.18	80.15	110.70
1	A	110	LEU	CA-C-N	-9.86	102.70	121.54
1	A	110	LEU	C-N-CA	-9.86	102.70	121.54
2	D	121	SER	CA-C-N	9.71	139.18	121.70
2	D	121	SER	C-N-CA	9.71	139.18	121.70
2	D	21	ASP	N-CA-C	-9.63	97.26	110.35
1	C	36	TYR	CA-C-N	8.71	128.36	119.56
1	C	36	TYR	C-N-CA	8.71	128.36	119.56

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	48	ASP	N-CA-C	8.53	128.97	110.80
2	D	94	GLU	N-CA-C	-7.79	104.00	113.97
1	A	17	ILE	CA-C-N	-7.55	103.36	121.80
1	A	17	ILE	C-N-CA	-7.55	103.36	121.80
1	C	75	ASP	N-CA-C	-7.36	104.43	113.41
1	A	107	LEU	N-CA-C	-7.21	103.51	111.36
2	D	124	THR	CA-C-N	-7.13	111.20	119.32
2	D	124	THR	C-N-CA	-7.13	111.20	119.32
2	D	47	ASN	CA-C-N	7.10	135.11	121.54
2	D	47	ASN	C-N-CA	7.10	135.11	121.54
2	D	35	TYR	CA-C-N	7.05	127.04	119.28
2	D	35	TYR	C-N-CA	7.05	127.04	119.28
1	A	47	LYS	CA-C-N	6.92	134.76	121.54
1	A	47	LYS	C-N-CA	6.92	134.76	121.54
2	B	47	ASN	N-CA-C	6.83	120.66	111.24
2	D	121	SER	O-C-N	-6.83	113.11	122.46
2	B	5	THR	N-CA-C	-6.79	103.67	112.23
1	C	133	LEU	N-CA-CB	-6.72	100.26	110.01
2	D	119	GLY	CA-C-N	6.63	126.32	119.82
2	D	119	GLY	C-N-CA	6.63	126.32	119.82
1	C	24	ILE	N-CA-C	-6.59	103.89	110.62
2	D	11	ILE	N-CA-C	6.53	116.67	110.53
1	A	91	GLN	N-CA-C	-6.52	104.97	113.12
1	A	78	THR	CB-CA-C	6.27	122.23	110.63
2	B	145	TYR	CA-CB-CG	-6.24	102.67	113.90
2	D	38	THR	N-CA-C	-6.23	104.94	112.54
2	D	60	VAL	N-CA-C	-6.21	104.28	110.30
2	B	103	PHE	N-CA-C	-6.19	104.64	111.82
1	C	63	VAL	N-CA-CB	6.17	117.77	110.55
2	D	30	ARG	N-CA-C	-6.15	104.58	111.28
1	C	69	GLU	N-CA-CB	6.13	119.67	110.22
1	A	47	LYS	N-CA-C	6.12	119.94	112.23
2	B	119	GLY	CA-C-N	6.10	125.99	119.28
2	B	119	GLY	C-N-CA	6.10	125.99	119.28
1	A	3	SER	N-CA-C	-6.06	101.22	110.14
1	A	32	MET	N-CA-C	-6.06	104.67	111.28
1	C	106	LEU	CB-CG-CD2	-6.04	92.56	110.70
1	C	79	ASN	N-CA-C	-6.00	98.75	108.41
1	A	85	SER	N-CA-C	5.87	117.35	111.07
2	B	11	ILE	CB-CA-C	-5.83	104.18	112.22
1	A	27	ASP	CB-CA-C	5.78	120.68	110.85
2	B	38	THR	N-CA-CB	-5.77	100.81	110.39

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	46	GLY	CA-C-O	-5.71	117.48	122.16
1	A	17	ILE	N-CA-C	-5.70	100.40	109.17
1	A	69	GLU	N-CA-C	-5.64	104.13	111.02
1	C	82	LEU	N-CA-C	5.61	117.84	111.11
1	C	21	ALA	N-CA-C	5.58	117.36	111.28
1	A	29	LEU	CB-CG-CD2	-5.55	94.04	110.70
2	D	46	GLY	O-C-N	5.53	126.67	123.08
1	A	77	LEU	N-CA-C	-5.48	105.31	111.28
1	C	99	PHE	N-CA-C	-5.46	105.33	111.28
1	A	110	LEU	CA-CB-CG	-5.43	97.31	116.30
1	C	13	PHE	N-CA-CB	-5.42	102.15	110.12
2	B	45	PHE	N-CA-C	5.39	119.86	113.28
1	A	106	LEU	N-CA-CB	-5.35	102.25	110.16
1	A	114	PHE	CA-C-N	5.33	126.50	119.84
1	A	114	PHE	C-N-CA	5.33	126.50	119.84
1	A	10	ILE	N-CA-C	5.31	116.08	110.72
2	B	47	ASN	N-CA-CB	5.25	119.95	111.65
1	A	75	ASP	N-CA-C	-5.23	106.75	113.23
2	B	145	TYR	N-CA-C	5.22	117.70	107.57
2	B	37	TRP	N-CA-C	-5.22	106.17	112.54
2	D	66	VAL	N-CA-C	5.21	116.56	110.62
1	A	110	LEU	O-C-N	-5.17	116.45	122.81
1	C	126	MET	CB-CG-SD	-5.15	97.26	112.70
2	B	126	ASP	N-CA-C	-5.12	105.78	112.23
2	D	118	PHE	N-CA-C	5.12	119.60	112.90
1	A	113	GLN	N-CA-C	5.10	119.21	112.89
2	B	46	GLY	N-CA-C	-5.08	105.78	111.63
2	D	112	VAL	N-CA-CB	5.07	118.19	110.58
1	C	108	VAL	N-CA-C	-5.06	105.46	110.62
2	D	25	PRO	CA-C-N	5.02	126.97	120.44
2	D	25	PRO	C-N-CA	5.02	126.97	120.44
2	D	96	LEU	N-CA-C	-5.02	107.84	114.31

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	48	ASP	CA

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	115	PRO	Peptide

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Group
1	A	18	SER	Peptide
1	A	47	LYS	Peptide
2	B	142	LEU	Peptide
2	B	46	GLY	Peptide
2	D	47	ASN	Peptide

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	1124	0	1144	87	0
1	C	1128	0	1145	82	0
2	B	1125	0	1126	39	0
2	D	1125	0	1126	47	0
3	A	43	0	30	5	0
3	B	43	0	30	1	0
3	C	43	0	30	10	0
3	D	43	0	30	1	0
4	A	2	0	0	3	0
4	B	2	0	0	0	0
4	C	2	0	0	0	0
4	D	2	0	0	1	0
5	A	31	0	0	10	0
5	B	13	0	0	2	0
5	C	25	0	0	11	0
5	D	21	0	0	3	0
All	All	4772	0	4661	259	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 28.

All (259) 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:110:LEU:O	1:A:111:ALA:CB	1.80	1.15
3:C:143:HEM:HBA2	3:C:143:HEM:HHA	1.23	1.12

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:4:ASP:O	1:A:8:ASP:OD2	1.67	1.10
1:A:110:LEU:HD12	1:A:110:LEU:H	1.10	1.09
1:A:32:MET:HE2	1:A:39:THR:HG21	1.37	1.07
2:B:21:ASP:OD1	2:B:65:LYS:HE2	1.56	1.05
1:A:106:LEU:O	1:A:110:LEU:CD1	2.05	1.04
1:A:79:ASN:HD22	1:A:80:GLY:N	1.61	0.98
1:C:30:ALA:HB2	1:C:56:VAL:HG11	1.45	0.96
1:C:22:GLU:OE1	1:C:61:LYS:HG3	1.66	0.95
2:B:144:ARG:HG3	2:B:144:ARG:HH11	1.29	0.94
1:A:110:LEU:HD12	1:A:110:LEU:N	1.73	0.92
1:C:107[A]:LEU:HD22	1:C:126:MET:HE3	1.53	0.91
2:B:21:ASP:OD1	2:B:65:LYS:CE	2.19	0.90
1:A:110:LEU:O	1:A:111:ALA:HB3	1.08	0.89
3:C:143:HEM:HBA2	3:C:143:HEM:CHA	1.97	0.88
2:D:82:LYS:HE3	2:D:145:TYR:HD2	1.38	0.88
1:C:107[A]:LEU:HD22	1:C:126:MET:CE	2.04	0.88
1:C:118:PHE:CZ	1:C:126:MET:HE1	2.10	0.87
1:A:121:GLU:HG3	5:A:157:HOH:O	1.75	0.86
1:A:86:GLU:OE2	1:A:90:PHE:CD1	2.30	0.85
2:B:15:TRP:CH2	2:B:72:GLU:HB2	2.11	0.85
1:A:106:LEU:O	1:A:110:LEU:HD12	1.76	0.84
1:A:106:LEU:O	1:A:110:LEU:HD13	1.78	0.84
2:D:82:LYS:HE3	2:D:145:TYR:CD2	2.13	0.83
1:A:32:MET:HE2	1:A:39:THR:CG2	2.09	0.82
2:B:139:VAL:O	2:B:143:SER:HB2	1.79	0.82
1:A:100:LYS:HE2	1:A:100:LYS:HA	1.62	0.81
1:C:136:SER:O	1:C:139[A]:GLU:HG2	1.80	0.81
1:A:87:LEU:HD12	1:A:91:GLN:HB3	1.63	0.81
1:C:111:ALA:HB2	1:C:118:PHE:CD1	2.15	0.81
1:A:6:ASP:O	1:A:10:ILE:HG23	1.81	0.81
1:C:107[B]:LEU:HD12	1:C:118:PHE:CE1	2.16	0.81
3:C:143:HEM:CMB	3:C:143:HEM:HBB2	2.09	0.80
2:B:144:ARG:HG3	2:B:144:ARG:NH1	1.95	0.80
2:D:21:ASP:O	2:D:22:GLU:HB3	1.81	0.80
2:B:35:TYR:O	2:B:38:THR:HB	1.82	0.80
1:A:79:ASN:HD22	1:A:79:ASN:C	1.90	0.80
1:A:86:GLU:OE2	1:A:90:PHE:HD1	1.66	0.78
1:C:47:LYS:HD3	1:C:47:LYS:N	1.97	0.78
1:C:17:ILE:HD11	1:C:114:PHE:CG	2.19	0.78
1:C:22:GLU:OE1	1:C:61:LYS:CG	2.31	0.78
2:B:89:SER:HA	2:B:142:LEU:O	1.85	0.77

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:143:HEM:NB	4:A:144:OXY:O1	2.17	0.76
2:D:47:ASN:O	2:D:57:ASN:ND2	2.18	0.76
2:D:117:LYS:HD3	2:D:118:PHE:CZ	2.21	0.76
2:D:92:HIS:HA	2:D:96:LEU:HD12	1.66	0.76
2:B:141:ALA:HA	2:B:145:TYR:HE1	1.50	0.76
2:D:22:GLU:HA	5:D:162:HOH:O	1.87	0.74
1:A:10:ILE:HD11	1:A:71:VAL:HG22	1.70	0.74
1:A:106:LEU:C	1:A:106:LEU:HD23	2.13	0.74
1:A:110:LEU:HD22	1:A:126:MET:HE3	1.69	0.73
1:C:107[B]:LEU:CD1	1:C:118:PHE:CE1	2.72	0.72
1:A:30:ALA:HB1	1:A:51:PRO:HA	1.71	0.72
1:C:124:VAL:O	1:C:128:LYS:HG3	1.88	0.72
1:A:61:LYS:HD3	5:A:153:HOH:O	1.88	0.72
2:B:140:ALA:O	2:B:143:SER:HB3	1.90	0.72
1:C:107[B]:LEU:CD1	1:C:118:PHE:HE1	2.03	0.71
1:C:118:PHE:HZ	1:C:126:MET:HE1	1.54	0.71
1:A:61:LYS:CD	5:A:153:HOH:O	2.41	0.69
1:C:111:ALA:HB1	2:D:116:MET:CG	2.23	0.69
2:B:140:ALA:O	2:B:143:SER:CB	2.41	0.69
1:C:128:LYS:O	1:C:132:LEU:HD12	1.93	0.68
1:A:100:LYS:HE2	1:A:100:LYS:CA	2.24	0.67
2:B:141:ALA:HA	2:B:145:TYR:CE1	2.29	0.66
1:A:45:HIS:CE1	3:A:143:HEM:O1D	2.49	0.66
1:A:136:SER:O	1:A:139:GLU:HG2	1.94	0.66
1:C:31:ARG:HD3	2:D:128:GLN:OE1	1.95	0.66
1:A:110:LEU:H	1:A:110:LEU:CD1	1.98	0.65
2:B:124:THR:HG21	5:B:161:HOH:O	1.97	0.65
2:B:18:ILE:HD13	2:B:118:PHE:HZ	1.62	0.64
2:D:133:LYS:O	2:D:137:VAL:HG23	1.98	0.64
1:C:107[A]:LEU:CD2	1:C:126:MET:HE3	2.27	0.63
1:A:30:ALA:HB2	1:A:56:VAL:HG11	1.80	0.63
2:B:73:ARG:NH2	2:B:84:ALA:O	2.30	0.63
2:D:21:ASP:O	2:D:22:GLU:CB	2.40	0.63
1:A:45:HIS:HE1	3:A:143:HEM:O1D	1.81	0.62
2:B:14:LEU:HD23	2:B:14:LEU:C	2.26	0.61
1:C:111:ALA:HB1	2:D:116:MET:HG3	1.82	0.61
3:C:143:HEM:HBB2	3:C:143:HEM:HMB1	1.81	0.61
1:A:32:MET:HG3	1:A:101:ILE:HG22	1.82	0.60
3:C:143:HEM:HHA	3:C:143:HEM:CBA	2.11	0.60
2:D:63:HIS:NE2	4:D:148:OXY:O1	2.31	0.60
2:D:19:SER:H	2:D:117:LYS:HE3	1.65	0.60

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:118:PHE:CZ	1:C:126:MET:CE	2.82	0.60
1:A:128:LYS:O	1:A:132:LEU:HD12	2.03	0.59
1:A:107:LEU:CD2	1:A:126:MET:HG3	2.32	0.59
1:C:81:LEU:HD23	1:C:136:SER:HB2	1.84	0.59
2:D:51:PRO:HD3	5:D:166:HOH:O	2.03	0.59
1:C:87:LEU:CD2	3:C:143:HEM:HBA1	2.32	0.58
1:A:79:ASN:ND2	1:A:80:GLY:N	2.43	0.58
2:B:91:MET:HE2	2:B:96:LEU:HD11	1.84	0.58
2:D:8:ARG:NH2	2:D:79:ASP:OD1	2.32	0.58
3:A:143:HEM:HAA1	5:A:160:HOH:O	2.03	0.58
1:C:58:LYS:CG	5:C:166:HOH:O	2.51	0.58
2:B:129:GLU:O	2:B:129:GLU:HG2	2.01	0.57
1:C:93:ARG:HG2	1:C:93:ARG:HH11	1.69	0.57
2:B:118:PHE:HB3	2:B:122:ALA:HB3	1.86	0.57
1:C:58:LYS:HG2	5:C:166:HOH:O	2.04	0.57
2:D:21:ASP:HA	2:D:65:LYS:HE2	1.87	0.57
2:D:47:ASN:HD21	2:D:49:SER:CB	2.18	0.57
2:B:124:THR:HG22	2:B:127:VAL:H	1.70	0.56
1:C:40:LYS:HG2	1:C:49:LEU:HD23	1.87	0.56
3:C:143:HEM:CHA	3:C:143:HEM:CBA	2.76	0.56
1:C:17:ILE:HD11	1:C:114:PHE:CD2	2.40	0.56
1:C:13:PHE:HE2	1:C:126:MET:SD	2.28	0.56
1:A:111:ALA:HB2	1:A:118:PHE:CD1	2.40	0.56
1:C:118:PHE:CE2	1:C:126:MET:HE1	2.40	0.56
1:C:17:ILE:HG12	1:C:110:LEU:HD22	1.87	0.55
1:C:107[A]:LEU:HD23	1:C:107[A]:LEU:H	1.69	0.55
1:C:83:THR:HG22	5:C:161:HOH:O	2.05	0.55
1:A:86:GLU:OE2	1:A:90:PHE:CE1	2.60	0.55
1:C:93:ARG:HH11	1:C:93:ARG:CG	2.20	0.55
2:D:19:SER:O	2:D:21:ASP:O	2.25	0.55
1:A:81:LEU:HD11	1:A:133:LEU:HD22	1.89	0.54
2:B:21:ASP:OD1	2:B:65:LYS:HE3	2.04	0.54
1:A:89:ALA:HB2	1:A:141:TYR:CD1	2.42	0.54
2:D:121:SER:N	2:D:122:ALA:HB3	2.23	0.53
1:A:115:PRO:HG3	5:A:175:HOH:O	2.08	0.53
2:B:24:GLY:HA2	2:B:68:MET:HE3	1.91	0.53
1:A:83:THR:HG23	5:A:146:HOH:O	2.08	0.53
1:A:13:PHE:CE1	1:A:126:MET:HE2	2.44	0.53
2:D:11:ILE:HD13	2:D:78:MET:HE1	1.91	0.52
2:D:101:ASP:OD2	2:D:104:ARG:NH2	2.38	0.52
1:A:87:LEU:CD1	1:A:91:GLN:HB3	2.37	0.52

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:118:PHE:CE2	1:C:126:MET:CE	2.93	0.52
2:B:103:PHE:HE2	2:B:143:SER:H	1.54	0.52
1:C:89:ALA:HB1	1:C:141:TYR:CD1	2.45	0.52
2:D:23:ILE:HD11	2:D:117:LYS:HD2	1.91	0.52
1:A:139:GLU:HG3	5:A:145:HOH:O	2.10	0.51
2:D:4:SER:OG	2:D:7:GLU:HG3	2.10	0.51
1:A:20:LYS:O	1:A:23:ASP:HB2	2.10	0.51
1:A:86:GLU:HG2	1:A:140:LYS:NZ	2.26	0.51
1:C:16:LYS:NZ	1:C:117:ASP:OD2	2.44	0.51
2:D:124:THR:O	2:D:125:PRO:C	2.50	0.51
1:A:87:LEU:CD1	1:A:91:GLN:HE21	2.24	0.51
1:A:142:ARG:HB3	2:D:36:PRO:HG3	1.93	0.51
1:A:100:LYS:HE2	1:A:100:LYS:O	2.11	0.51
1:A:111:ALA:HB2	1:A:118:PHE:CG	2.46	0.51
1:C:13:PHE:O	1:C:17:ILE:HB	2.11	0.51
1:A:1:SER:HB3	1:A:132:LEU:HD11	1.93	0.50
1:A:2:LEU:HG	1:A:132:LEU:HD13	1.93	0.50
1:C:1:SER:HA	1:C:132:LEU:HD21	1.92	0.50
1:C:34:THR:HG23	5:C:150:HOH:O	2.11	0.50
1:A:4:ASP:O	1:A:8:ASP:CG	2.52	0.50
1:C:118:PHE:HZ	1:C:126:MET:CE	2.21	0.50
2:D:22:GLU:O	2:D:26:GLN:HG3	2.11	0.50
1:C:31:ARG:O	1:C:32:MET:C	2.53	0.50
1:A:107:LEU:HD21	1:A:130:LEU:CD2	2.42	0.49
1:A:8:ASP:OD2	1:A:8:ASP:N	2.33	0.49
1:A:59:HIS:NE2	4:A:144:OXY:O2	2.32	0.49
2:B:140:ALA:O	2:B:143:SER:HB2	2.12	0.49
1:A:50:SER:HB2	1:A:51:PRO:HD2	1.93	0.49
1:A:107:LEU:HD22	1:A:126:MET:HG3	1.95	0.49
1:A:106:LEU:O	1:A:106:LEU:HD23	2.12	0.49
1:C:45:HIS:CD2	1:C:45:HIS:H	2.32	0.48
2:D:103:PHE:HB3	2:D:139:VAL:HG22	1.95	0.48
1:C:100:LYS:HB2	5:C:149:HOH:O	2.12	0.48
2:D:85:TYR:CD2	2:D:142:LEU:HG	2.48	0.48
1:C:10:ILE:HD11	1:C:125:SER:C	2.38	0.48
1:C:17:ILE:CD1	1:C:114:PHE:CG	2.95	0.48
1:C:54:ALA:HA	1:C:57:LYS:HE3	1.94	0.48
1:A:86:GLU:OE1	1:A:140:LYS:HD2	2.14	0.48
2:B:133:LYS:O	2:B:137:VAL:HG23	2.13	0.48
1:A:30:ALA:CB	1:A:51:PRO:HA	2.42	0.47
3:C:143:HEM:HHB	3:C:143:HEM:HMB2	1.35	0.47

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1:SER:CB	1:A:132:LEU:HD11	2.44	0.47
1:C:30:ALA:HB2	1:C:56:VAL:CG1	2.31	0.47
1:C:51:PRO:HD3	5:C:150:HOH:O	2.14	0.47
2:D:47:ASN:ND2	2:D:49:SER:H	2.13	0.47
1:C:13:PHE:CE2	1:C:126:MET:SD	3.06	0.47
2:D:137:VAL:O	2:D:138:VAL:C	2.58	0.47
1:C:107[A]:LEU:HD21	1:C:130:LEU:HD12	1.97	0.47
1:A:46:TRP:HA	1:A:47:LYS:HD3	1.96	0.47
1:A:24:ILE:HA	1:A:109:VAL:HG11	1.97	0.47
1:C:47:LYS:N	1:C:47:LYS:CD	2.70	0.47
2:D:85:TYR:HD2	2:D:142:LEU:HG	1.80	0.47
2:B:32:LEU:HD23	2:B:38:THR:CG2	2.45	0.46
2:B:18:ILE:HD13	2:B:118:PHE:CZ	2.45	0.46
1:C:132:LEU:HD22	5:C:163:HOH:O	2.14	0.46
1:A:86:GLU:HG2	1:A:140:LYS:HZ3	1.80	0.46
1:C:24:ILE:HD13	1:C:113:GLN:OE1	2.16	0.46
1:C:107[A]:LEU:HD22	1:C:126:MET:HE1	1.94	0.46
1:A:18:SER:C	1:A:20:LYS:N	2.70	0.46
2:B:32:LEU:HD23	2:B:38:THR:HG23	1.98	0.46
2:D:117:LYS:HD3	2:D:118:PHE:CE2	2.51	0.45
1:C:87:LEU:CD2	3:C:143:HEM:CBA	2.95	0.45
2:D:5:THR:HG23	5:D:150:HOH:O	2.16	0.45
1:A:86:GLU:CG	1:A:140:LYS:HZ3	2.29	0.45
1:C:95:ASP:HA	1:C:96:PRO:HD2	1.82	0.45
2:D:119:GLY:O	2:D:122:ALA:HB3	2.17	0.45
1:A:5:LYS:HA	1:A:8:ASP:OD2	2.17	0.45
1:A:18:SER:N	1:A:20:LYS:H	2.15	0.45
1:A:87:LEU:HD13	1:A:91:GLN:HE21	1.82	0.45
2:B:31:LEU:HG	2:B:38:THR:HG21	1.99	0.45
1:A:2:LEU:HD21	1:A:129:PHE:HA	1.99	0.44
1:A:14:TRP:O	1:A:17:ILE:O	2.35	0.44
3:A:143:HEM:NA	4:A:144:OXY:O1	2.50	0.44
1:C:126:MET:HB3	1:C:126:MET:HE2	1.38	0.44
2:B:40:ARG:NH1	1:C:41:THR:HG23	2.33	0.44
2:D:90:VAL:O	2:D:94:GLU:HB2	2.18	0.44
2:B:28:LEU:O	2:B:32:LEU:HG	2.17	0.44
1:C:66:SER:HB2	3:C:143:HEM:HMA2	2.00	0.44
1:C:81:LEU:HD21	1:C:133:LEU:HD22	1.99	0.44
2:B:15:TRP:CZ3	2:B:72:GLU:OE1	2.71	0.44
1:C:47:LYS:HE2	5:C:162:HOH:O	2.17	0.44
2:B:86:SER:O	2:B:90:VAL:HG23	2.18	0.43

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:18:ILE:N	2:D:18:ILE:HD13	2.33	0.43
1:A:79:ASN:C	1:A:79:ASN:ND2	2.64	0.43
2:B:106:LEU:O	2:B:110:ILE:HG13	2.19	0.43
1:C:130:LEU:O	1:C:133:LEU:HB3	2.18	0.43
1:A:54:ALA:HB3	1:A:55:PRO:HD3	2.01	0.43
1:C:90:PHE:CD1	1:C:140:LYS:HB3	2.53	0.43
1:A:47:LYS:HD3	1:A:47:LYS:N	2.34	0.43
1:C:107[B]:LEU:HD11	2:D:112:VAL:HG11	2.00	0.43
1:A:46:TRP:CH2	1:A:59:HIS:CB	3.02	0.43
2:B:20:VAL:HG22	2:B:68:MET:HB3	2.00	0.43
1:C:54:ALA:HB3	1:C:55:PRO:HD3	2.01	0.42
1:C:5:LYS:HE2	1:C:5:LYS:O	2.19	0.42
1:C:7:LYS:HZ2	1:C:7:LYS:HG3	1.63	0.42
1:A:107:LEU:O	1:A:108:VAL:C	2.61	0.42
1:A:128:LYS:O	1:A:132:LEU:CD1	2.67	0.42
1:C:10:ILE:HD11	1:C:126:MET:HA	2.00	0.42
2:D:47:ASN:ND2	2:D:49:SER:CB	2.83	0.42
1:A:30:ALA:CB	5:A:149:HOH:O	2.67	0.42
1:C:34:THR:CG2	5:C:150:HOH:O	2.67	0.42
1:A:61:LYS:HD2	5:A:153:HOH:O	2.10	0.42
1:C:10:ILE:CD1	1:C:126:MET:HA	2.49	0.42
1:C:58:LYS:HG3	5:C:166:HOH:O	2.19	0.42
1:C:93:ARG:CG	1:C:93:ARG:NH1	2.82	0.42
1:C:103:SER:HB2	1:C:130:LEU:HD13	2.02	0.42
1:A:115:PRO:HD2	1:A:116:ASN:CG	2.44	0.41
2:B:118:PHE:N	2:B:118:PHE:CD1	2.89	0.41
1:C:48:ASP:OD1	1:C:50:SER:OG	2.33	0.41
1:A:32:MET:CE	1:A:39:THR:HG21	2.28	0.41
1:A:121:GLU:H	1:A:121:GLU:HG2	1.64	0.41
1:C:30:ALA:HB3	5:C:145:HOH:O	2.20	0.41
2:B:57:ASN:HA	2:B:58:PRO:HD3	1.95	0.41
2:B:132:GLN:NE2	5:B:151:HOH:O	2.54	0.41
1:C:22:GLU:OE1	1:C:61:LYS:CB	2.68	0.41
2:D:35:TYR:HA	2:D:36:PRO:HD2	1.93	0.41
2:D:78:MET:HA	2:D:81:ILE:HG13	2.03	0.41
2:B:91:MET:HE1	3:B:147:HEM:HHA	2.03	0.41
1:C:57:LYS:HB2	1:C:58:LYS:HE3	2.01	0.41
2:D:108:ASP:O	2:D:112:VAL:HG13	2.21	0.41
1:A:61:LYS:HG2	5:A:156:HOH:O	2.20	0.41
1:A:100:LYS:HE2	1:A:100:LYS:C	2.46	0.41
1:C:66:SER:OG	1:C:84:LEU:HD11	2.20	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:23:ILE:HG22	2:D:68:MET:HE3	2.03	0.41
2:D:41:HIS:CD2	3:D:147:HEM:HBC1	2.56	0.41
1:A:50:SER:HA	1:A:51:PRO:HD3	1.91	0.40
1:A:62:THR:O	1:A:63:VAL:C	2.62	0.40
1:A:111:ALA:CB	1:A:118:PHE:CD1	3.04	0.40
1:C:82:LEU:HD21	1:C:140:LYS:CE	2.51	0.40
2:D:19:SER:H	2:D:117:LYS:CE	2.31	0.40
2:D:85:TYR:CE2	2:D:138:VAL:HG13	2.57	0.40
2:D:3:TRP:C	2:D:4:SER:O	2.63	0.40
1:C:76:ASP:O	1:C:79:ASN:O	2.40	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	141/142 (99%)	128 (91%)	9 (6%)	4 (3%)	4	3
1	C	142/142 (100%)	134 (94%)	7 (5%)	1 (1%)	18	28
2	B	144/146 (99%)	136 (94%)	6 (4%)	2 (1%)	9	13
2	D	144/146 (99%)	135 (94%)	5 (4%)	4 (3%)	4	3
All	All	571/576 (99%)	533 (93%)	27 (5%)	11 (2%)	6	8

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	18	SER
1	A	48	ASP
1	A	116	ASN
2	B	143	SER
2	D	122	ALA

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	D	22	GLU
2	D	48	LEU
1	A	111	ALA
2	B	93	SER
1	C	116	ASN
2	D	4	SER

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	126/125 (101%)	97 (77%)	29 (23%)	1	1
1	C	126/125 (101%)	98 (78%)	28 (22%)	1	1
2	B	118/118 (100%)	104 (88%)	14 (12%)	5	7
2	D	118/118 (100%)	108 (92%)	10 (8%)	10	16
All	All	488/486 (100%)	407 (83%)	81 (17%)	2	3

All (81) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	SER
1	A	5	LYS
1	A	8	ASP
1	A	10	ILE
1	A	16	LYS
1	A	18	SER
1	A	22	GLU
1	A	27	ASP
1	A	34	THR
1	A	38	GLN
1	A	47	LYS
1	A	58[A]	LYS
1	A	58[B]	LYS
1	A	61	LYS
1	A	69	GLU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	72	SER
1	A	78	THR
1	A	79	ASN
1	A	82	LEU
1	A	83	THR
1	A	96	PRO
1	A	100	LYS
1	A	106	LEU
1	A	121	GLU
1	A	130	LEU
1	A	132	LEU
1	A	133	LEU
1	A	134	SER
1	A	138	SER
2	B	2	GLU
2	B	15	TRP
2	B	17	LYS
2	B	26	GLN
2	B	38	THR
2	B	40	ARG
2	B	47	ASN
2	B	72	GLU
2	B	82	LYS
2	B	93	SER
2	B	106	LEU
2	B	124	THR
2	B	139	VAL
2	B	144	ARG
1	C	4	ASP
1	C	5	LYS
1	C	16	LYS
1	C	17	ILE
1	C	22	GLU
1	C	23	ASP
1	C	27	ASP
1	C	38	GLN
1	C	44	SER
1	C	50	SER
1	C	58	LYS
1	C	61	LYS
1	C	69	GLU
1	C	81	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	C	82	LEU
1	C	83	THR
1	C	90	PHE
1	C	91	GLN
1	C	93	ARG
1	C	106	LEU
1	C	107[A]	LEU
1	C	107[B]	LEU
1	C	121	GLU
1	C	124	VAL
1	C	132	LEU
1	C	133	LEU
1	C	139[A]	GLU
1	C	139[B]	GLU
2	D	5	THR
2	D	9	SER
2	D	14	LEU
2	D	18	ILE
2	D	21	ASP
2	D	48	LEU
2	D	86	SER
2	D	94	GLU
2	D	112	VAL
2	D	145	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	45	HIS
1	A	79	ASN
1	A	91	GLN
1	A	105	ASN
1	A	116	ASN
2	B	47	ASN
2	B	132	GLN
1	C	38	GLN
1	C	45	HIS
2	D	41	HIS
2	D	47	ASN
2	D	102	ASN

5.3.3 RNA ⓘ

There are no RNA molecules 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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

8 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	HEM	B	147	4,2	50,50,50	2.22	11 (22%)	67,82,82	1.93	23 (34%)
4	OXY	B	148	3	1,1,1	0.14	0	-		
4	OXY	D	148	3	1,1,1	0.19	0	-		
4	OXY	A	144	3	1,1,1	0.20	0	-		
4	OXY	C	144	3	1,1,1	0.22	0	-		
3	HEM	D	147	4,2	50,50,50	2.25	13 (26%)	67,82,82	1.90	19 (28%)
3	HEM	C	143	1,4	50,50,50	3.23	26 (52%)	67,82,82	3.78	40 (59%)
3	HEM	A	143	1,4	50,50,50	2.13	14 (28%)	67,82,82	2.11	20 (29%)

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
3	HEM	B	147	4,2	-	3/14/54/54	-

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	HEM	D	147	4,2	-	6/14/54/54	-
3	HEM	C	143	1,4	-	4/14/54/54	-
3	HEM	A	143	1,4	-	4/14/54/54	-

All (64) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	147	HEM	C3D-C2D	8.56	1.55	1.36
3	C	143	HEM	CMC-C2C	7.74	1.66	1.50
3	C	143	HEM	FE-NB	7.63	2.18	1.94
3	C	143	HEM	C3D-C2D	7.42	1.52	1.36
3	B	147	HEM	FE-NA	7.41	2.19	1.95
3	A	143	HEM	C3D-C2D	6.63	1.51	1.36
3	B	147	HEM	C3D-C2D	6.42	1.50	1.36
3	D	147	HEM	FE-NB	6.24	2.14	1.94
3	C	143	HEM	FE-NC	6.12	2.15	1.95
3	D	147	HEM	FE-ND	6.05	2.13	1.94
3	C	143	HEM	CMB-C2B	5.65	1.62	1.50
3	C	143	HEM	C4A-NA	5.58	1.50	1.39
3	A	143	HEM	FE-NC	5.51	2.13	1.95
3	C	143	HEM	C4B-NB	5.37	1.49	1.38
3	C	143	HEM	FE-NA	5.29	2.12	1.95
3	B	147	HEM	FE-NB	4.59	2.09	1.94
3	A	143	HEM	C4C-NC	-4.54	1.31	1.39
3	C	143	HEM	CMA-C3A	4.36	1.59	1.50
3	C	143	HEM	CMD-C2D	4.32	1.59	1.50
3	B	147	HEM	FE-NC	4.14	2.08	1.95
3	A	143	HEM	FE-NA	4.08	2.08	1.95
3	C	143	HEM	CBB-CAB	4.00	1.49	1.30
3	B	147	HEM	CAB-C3B	3.99	1.58	1.47
3	A	143	HEM	CMC-C2C	3.86	1.58	1.50
3	C	143	HEM	C1B-C2B	-3.80	1.36	1.44
3	B	147	HEM	FE-ND	3.58	2.05	1.94
3	C	143	HEM	CAB-C3B	3.44	1.56	1.47
3	A	143	HEM	CMD-C2D	3.25	1.57	1.50
3	D	147	HEM	CMB-C2B	3.16	1.57	1.50
3	B	147	HEM	CAC-C3C	3.15	1.55	1.47
3	C	143	HEM	CHC-C4B	3.13	1.46	1.39
3	C	143	HEM	C1C-C2C	-2.98	1.39	1.45
3	A	143	HEM	CAB-C3B	2.95	1.55	1.47
3	A	143	HEM	CAC-C3C	2.94	1.55	1.47
3	D	147	HEM	CAB-C3B	2.91	1.55	1.47

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	143	HEM	O1A-CGA	2.84	1.31	1.22
3	B	147	HEM	CMC-C2C	2.81	1.56	1.50
3	D	147	HEM	CMA-C3A	2.81	1.56	1.50
3	C	143	HEM	CHD-C4C	2.79	1.43	1.38
3	A	143	HEM	CMA-C3A	2.71	1.56	1.50
3	A	143	HEM	FE-NB	2.69	2.03	1.94
3	D	147	HEM	CHA-C4D	-2.67	1.33	1.38
3	D	147	HEM	CAC-C3C	2.66	1.54	1.47
3	C	143	HEM	C4D-C3D	2.59	1.49	1.45
3	C	143	HEM	C1B-NB	-2.53	1.35	1.40
3	D	147	HEM	FE-NC	2.50	2.03	1.95
3	C	143	HEM	CHA-C4D	2.49	1.43	1.38
3	D	147	HEM	CMC-C2C	2.43	1.55	1.50
3	A	143	HEM	O1A-CGA	2.42	1.30	1.22
3	C	143	HEM	CHB-C4A	2.37	1.44	1.39
3	A	143	HEM	C1B-NB	2.37	1.44	1.40
3	B	147	HEM	C4C-NC	-2.35	1.35	1.39
3	A	143	HEM	CMB-C2B	2.30	1.55	1.50
3	C	143	HEM	C1C-NC	-2.29	1.35	1.39
3	C	143	HEM	C2A-C3A	-2.25	1.33	1.38
3	D	147	HEM	C3C-C4C	-2.19	1.42	1.46
3	D	147	HEM	O1D-CGD	2.18	1.29	1.22
3	D	147	HEM	C2A-C3A	-2.12	1.33	1.38
3	A	143	HEM	C4A-NA	-2.11	1.35	1.39
3	C	143	HEM	C4A-C3A	2.10	1.48	1.43
3	B	147	HEM	CBD-CGD	2.06	1.55	1.50
3	C	143	HEM	CAC-C3C	2.05	1.52	1.47
3	B	147	HEM	CAA-C2A	2.05	1.56	1.51
3	C	143	HEM	C4D-ND	2.02	1.43	1.40

All (102) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	143	HEM	CMB-C2B-C1B	-13.37	104.14	125.03
3	C	143	HEM	CMB-C2B-C3B	7.34	146.20	128.43
3	C	143	HEM	CAD-C3D-C2D	-7.22	114.35	127.87
3	C	143	HEM	CMA-C3A-C4A	7.16	136.31	125.42
3	B	147	HEM	C4D-ND-C1D	6.43	112.82	105.21
3	A	143	HEM	CHA-C4D-ND	6.16	131.99	124.37
3	C	143	HEM	CAD-C3D-C4D	6.12	135.37	124.70
3	C	143	HEM	C2A-C1A-NA	-6.12	103.37	110.15
3	C	143	HEM	C3B-C4B-NB	-5.90	105.23	109.47

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	147	HEM	C4D-ND-C1D	5.83	112.11	105.21
3	C	143	HEM	C3D-C4D-ND	-5.62	104.00	110.17
3	C	143	HEM	C3A-C4A-NA	-5.52	101.29	110.14
3	C	143	HEM	CHB-C1B-NB	5.19	130.78	124.37
3	C	143	HEM	C1A-C2A-C3A	5.12	114.80	106.87
3	C	143	HEM	CBB-CAB-C3B	-5.00	102.53	127.53
3	C	143	HEM	C1D-C2D-C3D	-4.79	101.94	106.98
3	B	147	HEM	CHC-C4B-NB	4.78	129.56	124.42
3	A	143	HEM	C4D-ND-C1D	4.77	110.85	105.21
3	C	143	HEM	C4D-ND-C1D	4.75	110.83	105.21
3	C	143	HEM	CMA-C3A-C2A	-4.74	115.57	125.62
3	A	143	HEM	CHC-C4B-NB	4.64	129.42	124.42
3	C	143	HEM	CHD-C1D-C2D	-4.57	117.82	125.03
3	C	143	HEM	CHA-C1A-NA	4.54	132.09	123.86
3	C	143	HEM	CBD-CAD-C3D	-4.34	100.53	112.53
3	C	143	HEM	C3B-C2B-C1B	4.31	109.65	106.41
3	A	143	HEM	CAD-CBD-CGD	-4.31	102.24	113.67
3	D	147	HEM	CBA-CAA-C2A	-4.27	100.72	112.53
3	C	143	HEM	CHD-C1D-ND	4.27	129.02	124.42
3	A	143	HEM	CMA-C3A-C4A	-4.27	118.92	125.42
3	C	143	HEM	C4A-NA-C1A	4.09	112.50	105.82
3	D	147	HEM	C3B-C4B-NB	-3.93	106.64	109.47
3	A	143	HEM	CMA-C3A-C2A	3.90	133.90	125.62
3	A	143	HEM	C4B-C3B-C2B	3.85	110.82	107.28
3	C	143	HEM	C4A-CHB-C1B	-3.85	117.19	126.25
3	B	147	HEM	CAD-C3D-C4D	3.71	131.16	124.70
3	D	147	HEM	CHD-C4C-NC	3.51	128.27	124.45
3	D	147	HEM	C3C-C2C-C1C	3.41	110.27	107.05
3	C	143	HEM	CMC-C2C-C3C	3.38	136.60	128.43
3	A	143	HEM	C1D-C2D-C3D	-3.32	103.49	106.98
3	B	147	HEM	C3A-C4A-NA	-3.31	104.83	110.14
3	C	143	HEM	CHB-C1B-C2B	-3.29	117.58	126.95
3	B	147	HEM	C4A-NA-C1A	3.27	111.16	105.82
3	C	143	HEM	CMD-C2D-C1D	3.27	130.14	125.03
3	D	147	HEM	CBD-CAD-C3D	-3.26	103.51	112.53
3	C	143	HEM	CMC-C2C-C1C	-3.23	119.04	124.73
3	A	143	HEM	CMD-C2D-C1D	3.23	130.08	125.03
3	D	147	HEM	C1B-NB-C4B	3.18	108.97	105.21
3	D	147	HEM	C4C-NC-C1C	3.17	110.99	105.82
3	A	143	HEM	C2A-C1A-NA	-3.16	106.65	110.15
3	D	147	HEM	CHA-C1A-NA	3.15	129.58	123.86
3	C	143	HEM	CHC-C4B-NB	3.10	127.76	124.42

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	143	HEM	CHA-C4D-C3D	3.07	130.88	125.23
3	B	147	HEM	CMD-C2D-C1D	3.01	129.74	125.03
3	D	147	HEM	CMB-C2B-C1B	-2.98	120.38	125.03
3	C	143	HEM	CHC-C1C-C2C	-2.97	119.31	125.49
3	B	147	HEM	C3D-C4D-ND	-2.90	106.99	110.17
3	D	147	HEM	C2C-C1C-NC	-2.86	104.34	109.64
3	C	143	HEM	C3C-C2C-C1C	-2.84	104.36	107.05
3	B	147	HEM	CHD-C4C-C3C	2.83	129.99	125.21
3	C	143	HEM	CHB-C4A-C3A	2.82	135.60	127.43
3	A	143	HEM	CAC-C3C-C4C	-2.80	118.12	124.82
3	C	143	HEM	C2C-C1C-NC	2.80	114.82	109.64
3	C	143	HEM	C2D-C1D-ND	2.80	113.14	109.90
3	B	147	HEM	C2A-C1A-NA	-2.77	107.08	110.15
3	B	147	HEM	CAD-C3D-C2D	-2.76	122.70	127.87
3	A	143	HEM	C4A-CHB-C1B	-2.73	119.82	126.25
3	A	143	HEM	C3B-C4B-NB	-2.70	107.53	109.47
3	D	147	HEM	C4B-C3B-C2B	2.66	109.72	107.28
3	C	143	HEM	CAC-C3C-C4C	-2.64	118.52	124.82
3	C	143	HEM	CBC-CAC-C3C	-2.62	114.43	127.53
3	B	147	HEM	CAD-CBD-CGD	-2.58	106.83	113.67
3	D	147	HEM	CHC-C4B-C3B	2.57	130.20	125.07
3	C	143	HEM	CAA-C2A-C1A	-2.57	119.93	124.94
3	A	143	HEM	CHA-C4D-C3D	-2.56	120.51	125.23
3	B	147	HEM	O2D-CGD-CBD	2.55	122.07	114.00
3	B	147	HEM	CBA-CAA-C2A	-2.54	105.50	112.53
3	D	147	HEM	C1D-C2D-C3D	-2.51	104.34	106.98
3	B	147	HEM	C4A-C3A-C2A	2.48	109.66	106.82
3	B	147	HEM	CHD-C1D-ND	2.47	127.08	124.42
3	D	147	HEM	C2A-C1A-NA	-2.46	107.43	110.15
3	C	143	HEM	C4C-CHD-C1D	-2.44	120.83	126.02
3	A	143	HEM	C3D-C4D-ND	-2.44	107.50	110.17
3	B	147	HEM	C1B-NB-C4B	2.44	108.09	105.21
3	A	143	HEM	C3C-C2C-C1C	-2.37	104.80	107.05
3	B	147	HEM	CHB-C4A-NA	2.32	128.08	123.86
3	D	147	HEM	CHB-C4A-NA	2.31	128.05	123.86
3	D	147	HEM	CHC-C1C-NC	2.29	126.94	124.45
3	B	147	HEM	O1A-CGA-CBA	-2.28	115.86	123.09
3	A	143	HEM	C4C-C3C-C2C	2.27	108.78	106.81
3	A	143	HEM	CHA-C1A-C2A	2.27	130.27	125.30
3	B	147	HEM	CHC-C4B-C3B	-2.22	120.64	125.07
3	B	147	HEM	C2B-C1B-NB	-2.21	107.30	109.84
3	C	143	HEM	C4D-C3D-C2D	2.17	110.05	106.89

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	147	HEM	O2A-CGA-CBA	2.16	120.82	114.00
3	A	143	HEM	C1B-NB-C4B	2.15	107.76	105.21
3	B	147	HEM	C3B-C2B-C1B	2.14	108.02	106.41
3	D	147	HEM	CMD-C2D-C3D	2.13	131.91	126.15
3	B	147	HEM	C4C-NC-C1C	2.13	109.29	105.82
3	C	143	HEM	CAD-CBD-CGD	-2.11	108.06	113.67
3	C	143	HEM	C4C-C3C-C2C	2.08	108.62	106.81
3	D	147	HEM	CMB-C2B-C3B	2.06	133.41	128.43
3	A	143	HEM	CHB-C4A-C3A	-2.04	121.50	127.43

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	143	HEM	C2C-C3C-CAC-CBC
3	B	147	HEM	C2C-C3C-CAC-CBC
3	B	147	HEM	C4C-C3C-CAC-CBC
3	C	143	HEM	C1A-C2A-CAA-CBA
3	D	147	HEM	C2B-C3B-CAB-CBB
3	D	147	HEM	C4B-C3B-CAB-CBB
3	C	143	HEM	C3A-C2A-CAA-CBA
3	A	143	HEM	C4C-C3C-CAC-CBC
3	D	147	HEM	CAA-CBA-CGA-O1A
3	D	147	HEM	CAA-CBA-CGA-O2A
3	D	147	HEM	CAD-CBD-CGD-O1D
3	D	147	HEM	CAD-CBD-CGD-O2D
3	A	143	HEM	CAD-CBD-CGD-O2D
3	C	143	HEM	CAA-CBA-CGA-O2A
3	A	143	HEM	CAD-CBD-CGD-O1D
3	C	143	HEM	CAA-CBA-CGA-O1A
3	B	147	HEM	CAD-CBD-CGD-O2D

There are no ring outliers.

6 monomers are involved in 19 short contacts:

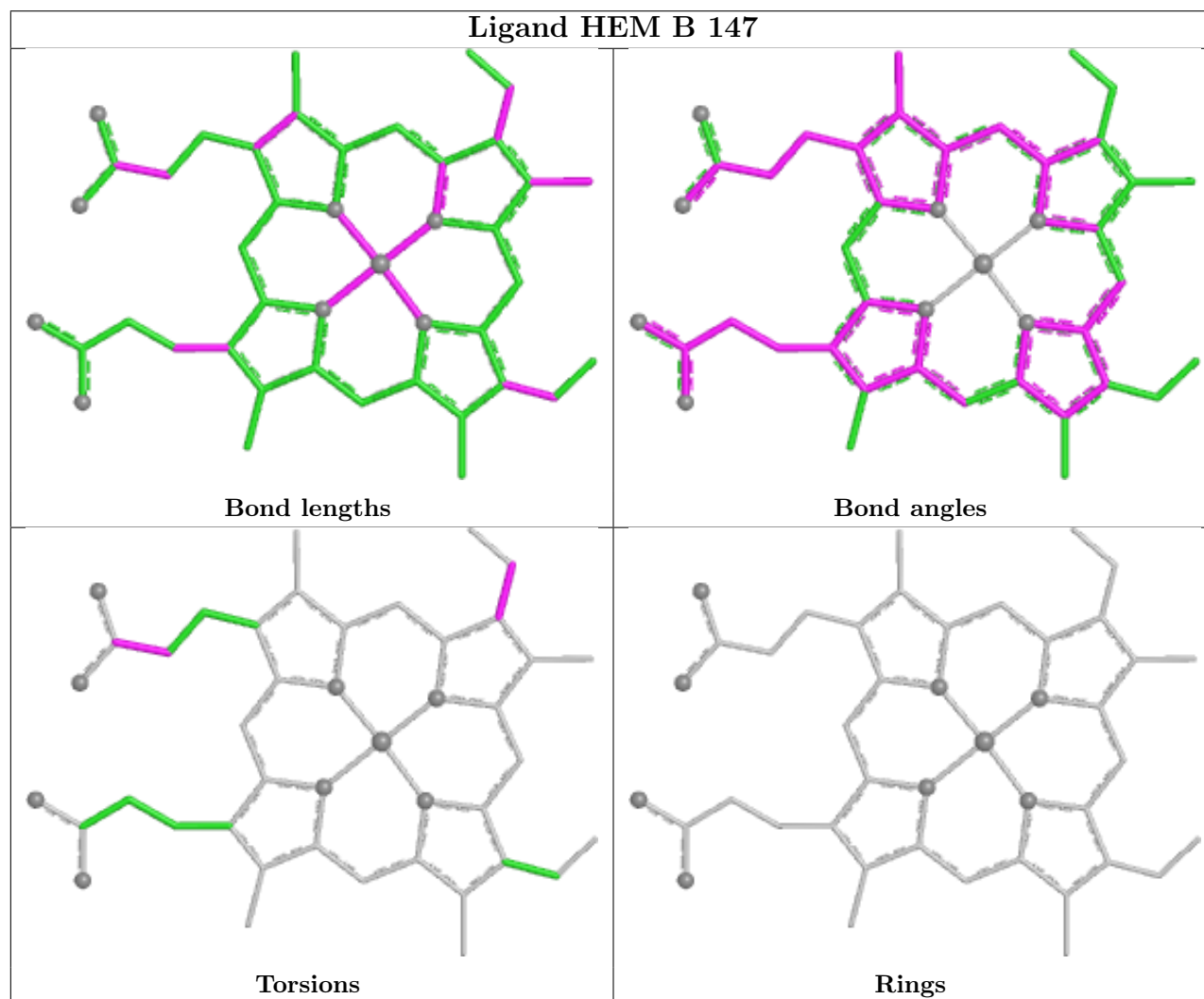
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	147	HEM	1	0
4	D	148	OXY	1	0
4	A	144	OXY	3	0
3	D	147	HEM	1	0
3	C	143	HEM	10	0

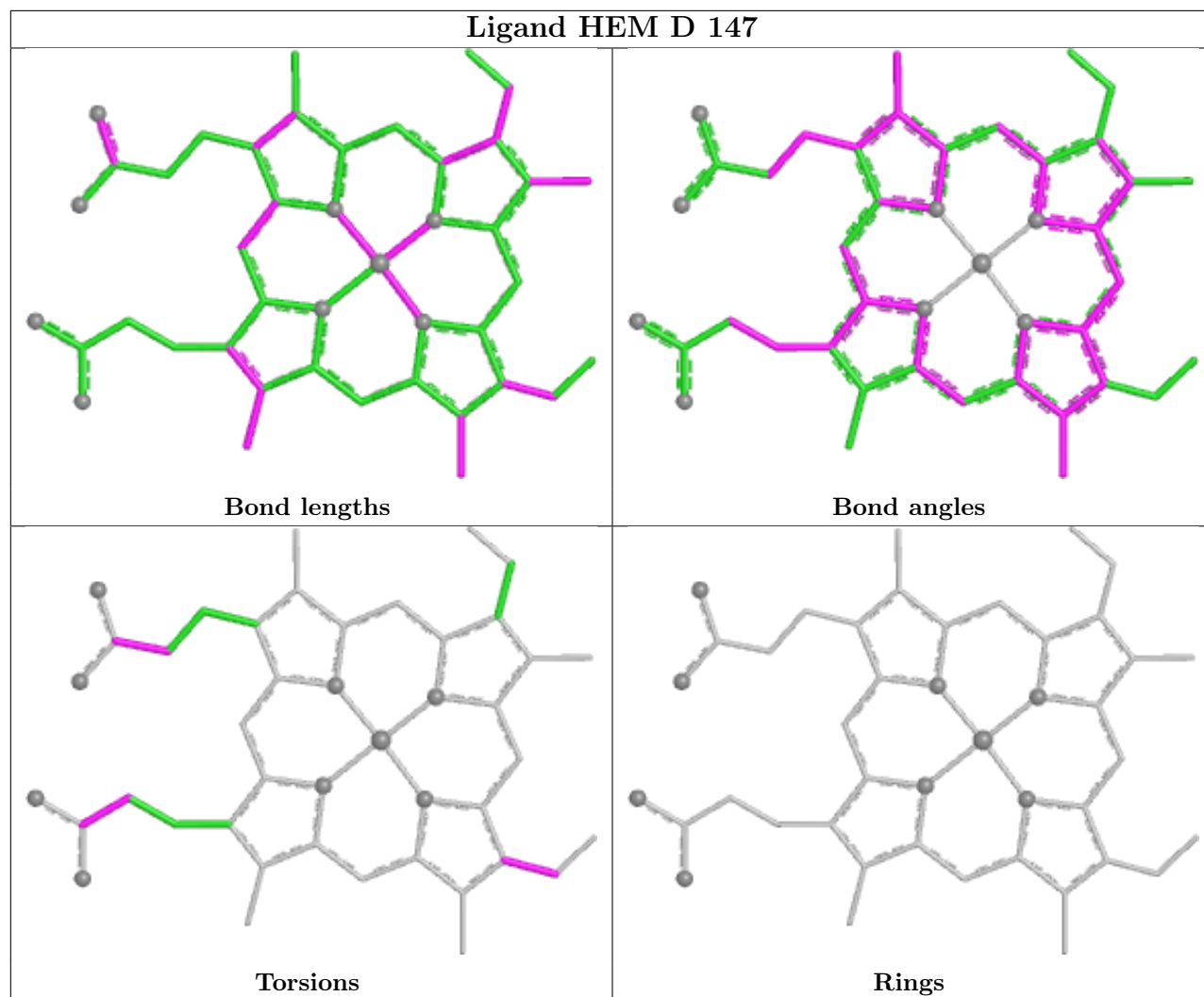
Continued on next page...

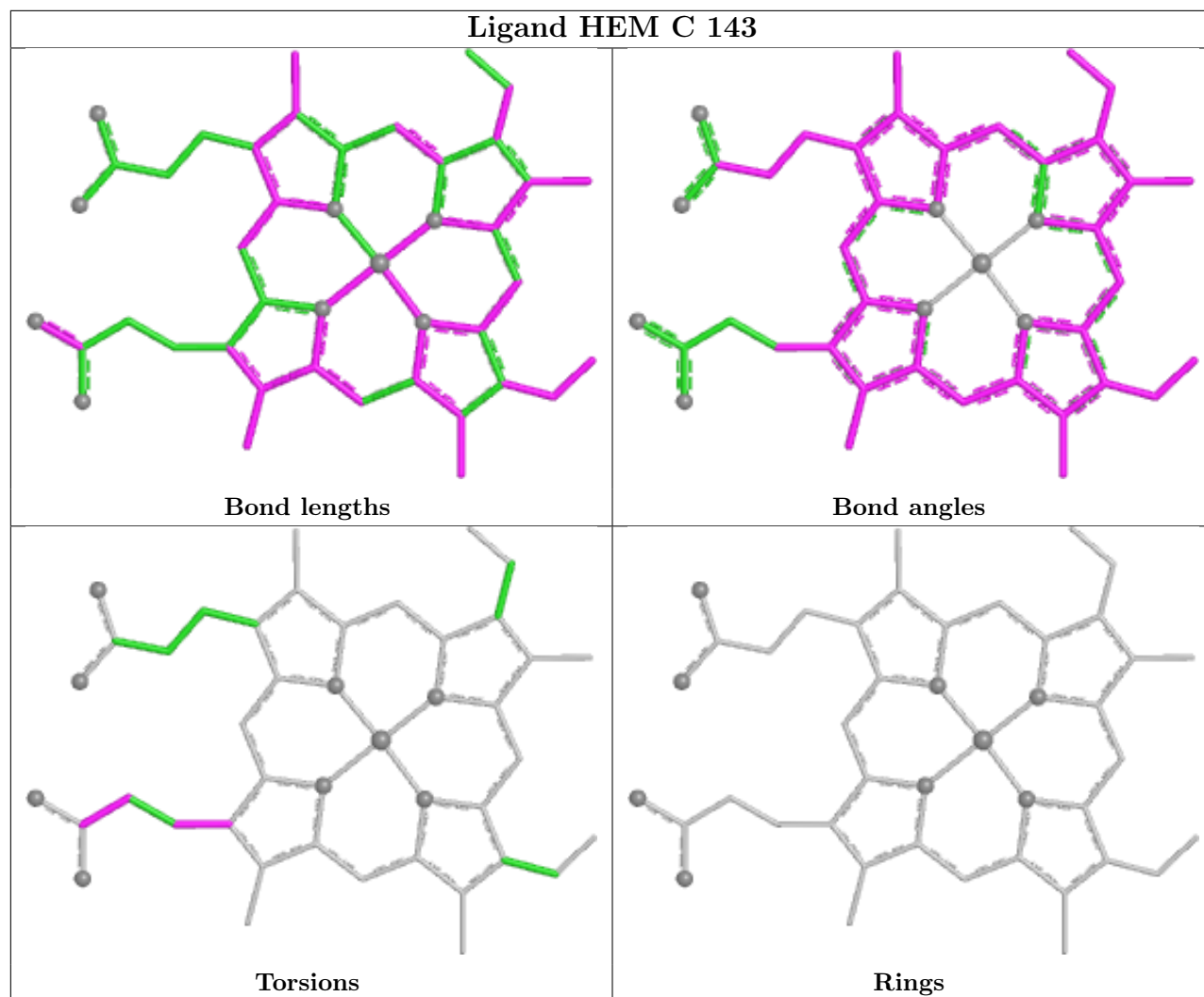
Continued from previous page...

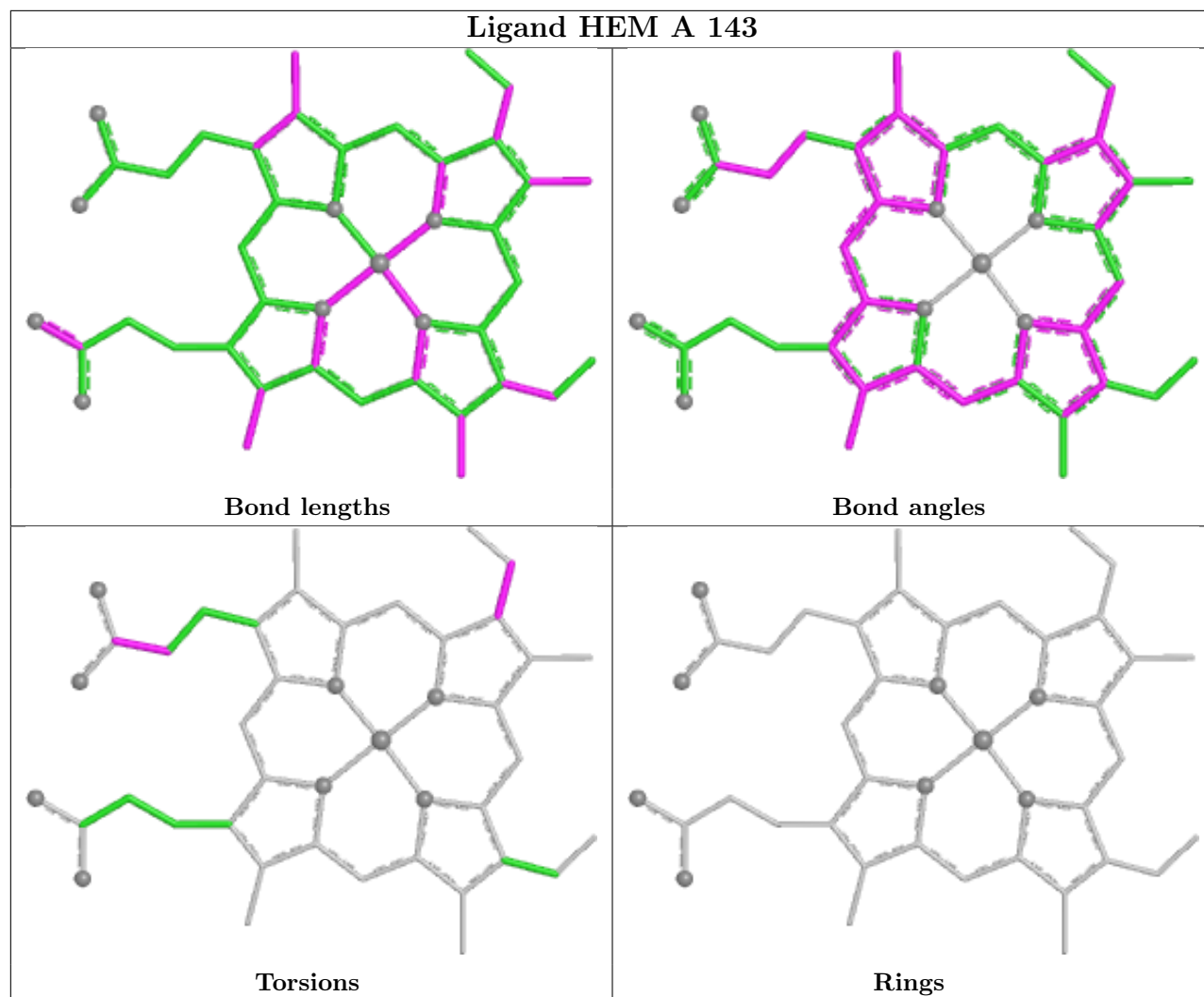
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	143	HEM	5	0

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 [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(Å ²)	Q<0.9
1	A	142/142 (100%)	-0.40	1 (0%) 84 81	21, 37, 52, 61	2 (1%)
1	C	142/142 (100%)	-0.35	2 (1%) 73 69	16, 35, 51, 58	5 (3%)
2	B	146/146 (100%)	-0.50	0 100 100	24, 40, 59, 71	1 (0%)
2	D	146/146 (100%)	-0.50	2 (1%) 73 69	24, 40, 56, 69	1 (0%)
All	All	576/576 (100%)	-0.44	5 (0%) 81 78	16, 38, 56, 71	9 (1%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	13	PHE	2.8
2	D	143	SER	2.5
2	D	145	TYR	2.5
1	A	116	ASN	2.3
1	C	138	SER	2.1

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,

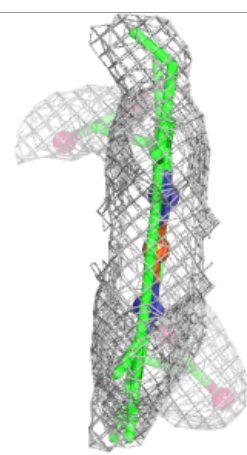
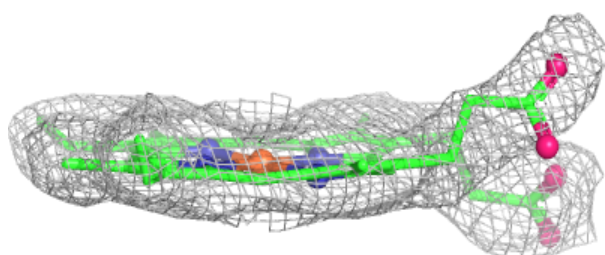
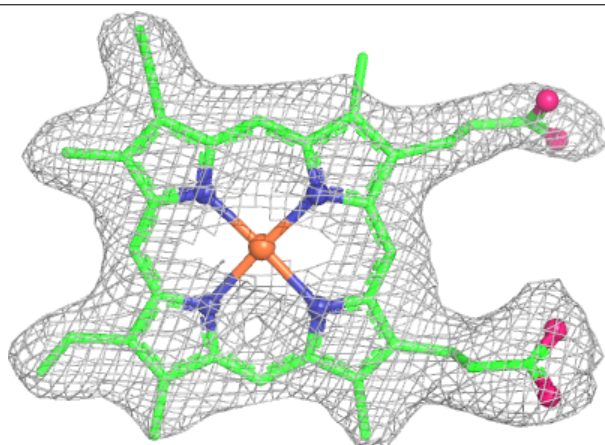
median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	HEM	B	147	43/43	0.97	0.06	31,37,58,61	0
3	HEM	D	147	43/43	0.97	0.06	26,36,55,63	0
3	HEM	C	143	43/43	0.98	0.06	20,27,48,57	0
3	HEM	A	143	43/43	0.98	0.04	23,29,48,60	0
4	OXY	A	144	2/2	0.98	0.13	22,22,22,26	0
4	OXY	B	148	2/2	0.98	0.17	48,48,48,52	0
4	OXY	C	144	2/2	0.98	0.14	36,36,36,40	0
4	OXY	D	148	2/2	0.98	0.09	26,26,26,30	2

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.

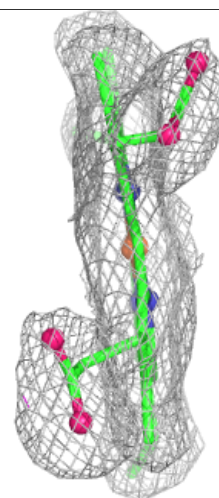
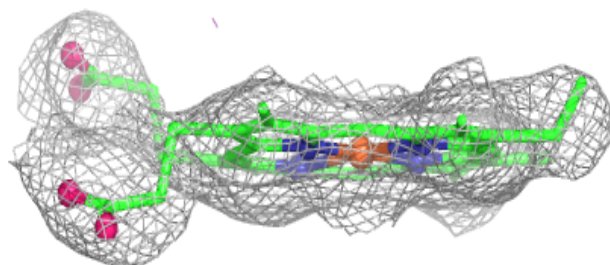
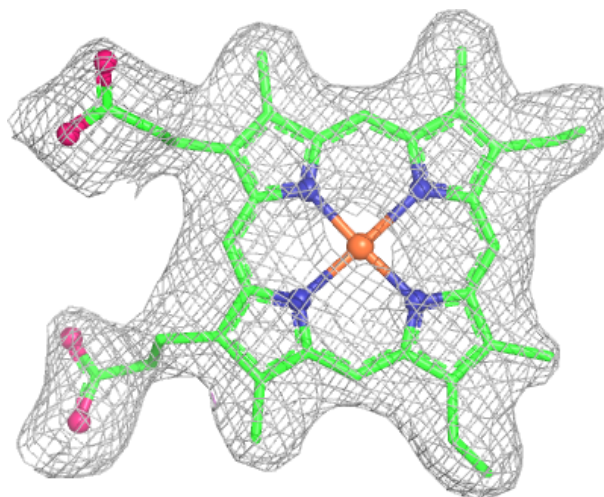
Electron density around HEM B 147:

2mF_o-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



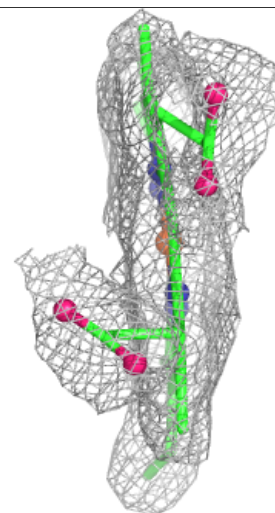
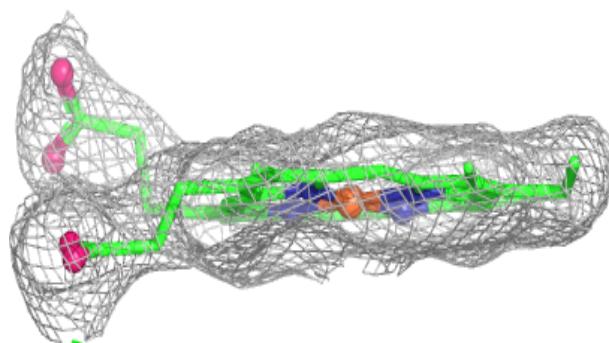
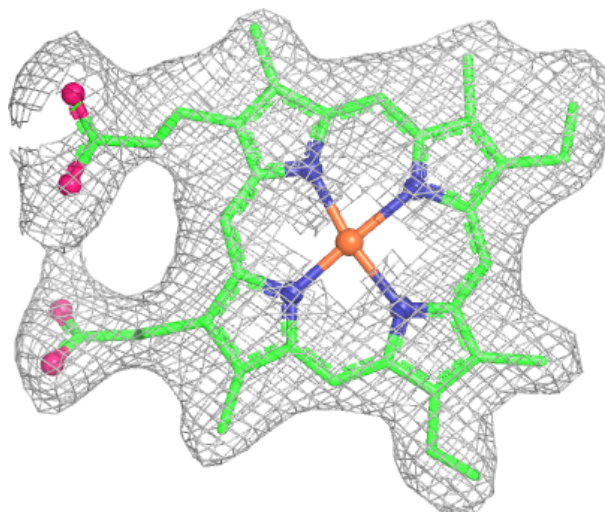
Electron density around HEM D 147:

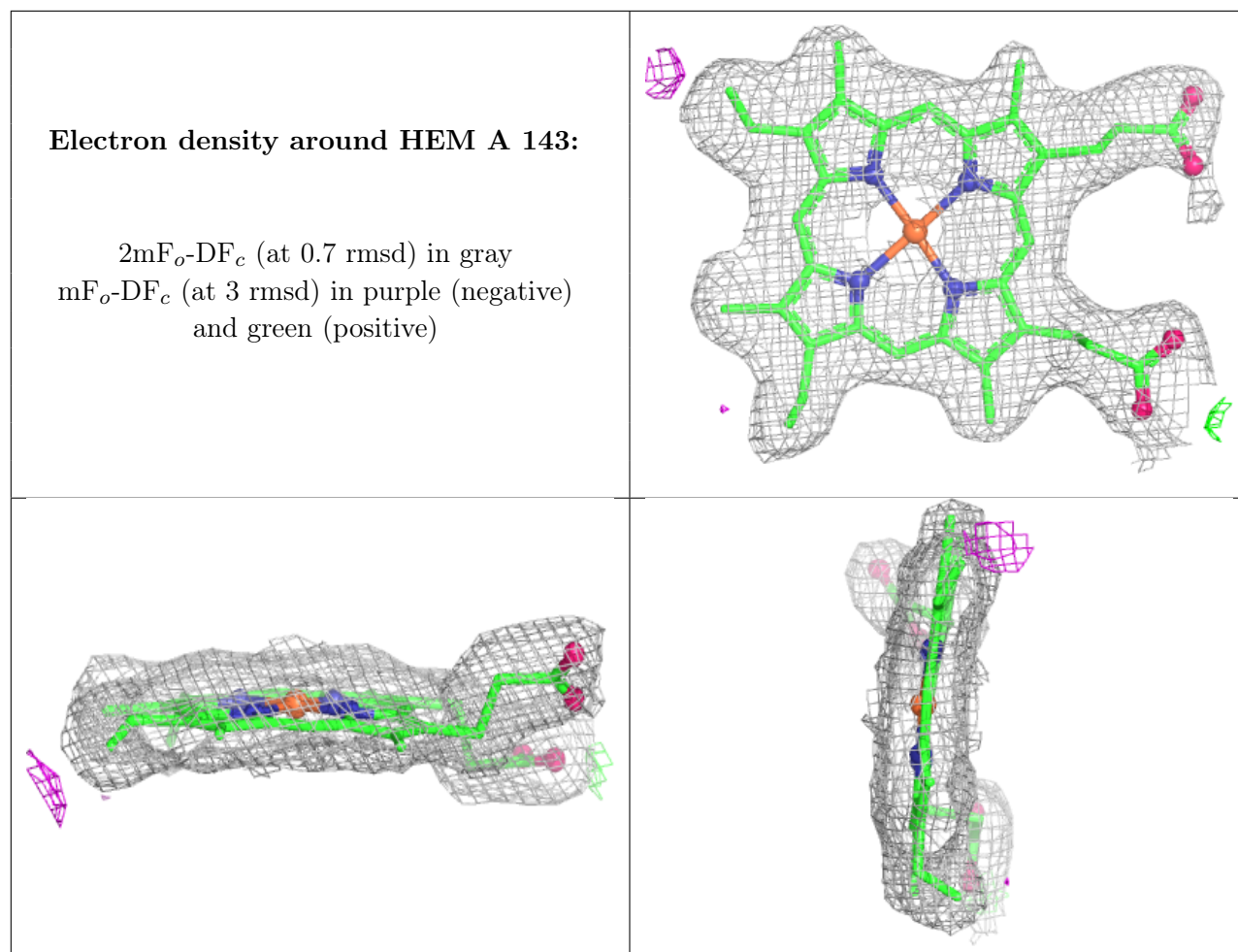
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM C 143:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





6.5 Other polymers [i](#)

There are no such residues in this entry.