Full wwPDB X-ray Structure Validation Report ⓘ

Apr 29, 2025 – 03:12 AM EDT

PDB ID	:	3HQ8 / pdb_00003hq8
Title	:	CcpA from G. sulfurreducens S134P/V135K variant
Authors	:	Hoffmann, M.; Seidel, J.; Einsle, O.
Deposited on	:	2009-06-05
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:

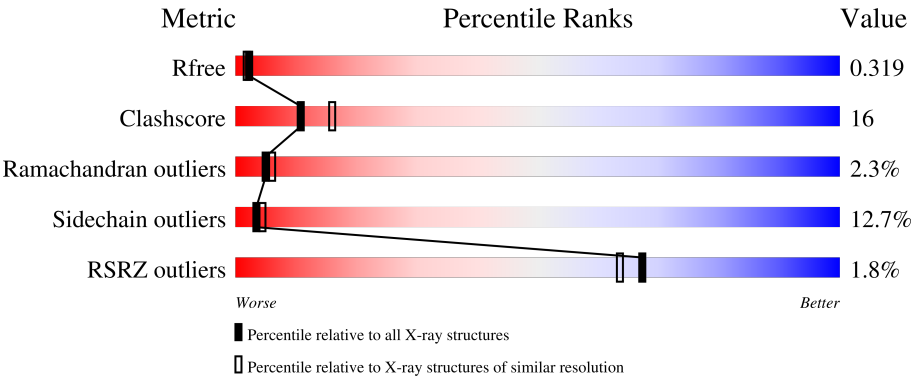
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.43.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

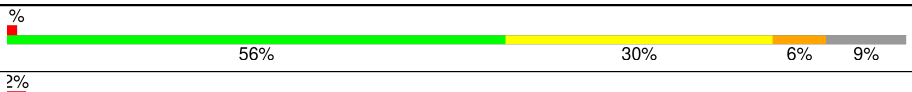
The reported resolution of this entry is 2.40 Å.

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}	164625	4642 (2.40-2.40)
Clashscore	180529	5218 (2.40-2.40)
Ramachandran outliers	177936	5158 (2.40-2.40)
Sidechain outliers	177891	5159 (2.40-2.40)
RSRZ outliers	164620	4642 (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 <=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	345	
1	B	345	

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 5094 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.

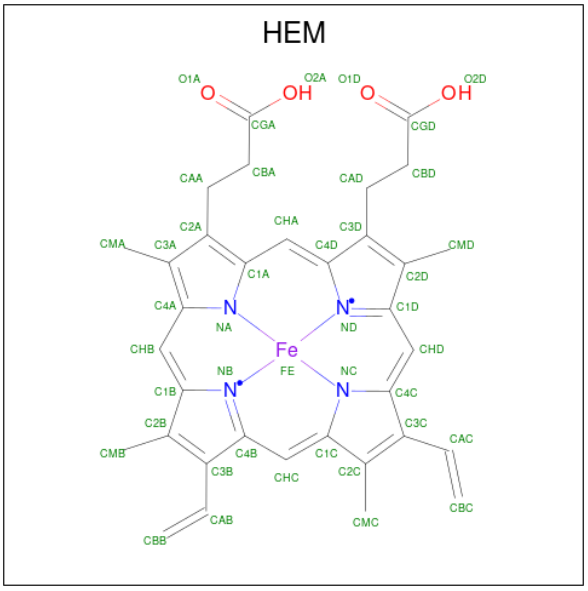
- Molecule 1 is a protein called Cytochrome c551 peroxidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	315	Total	C	N	O	S	0	0	0
			2385	1525	408	443	9			
1	B	313	Total	C	N	O	S	0	1	0
			2381	1521	408	443	9			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	134	PRO	SER	engineered mutation	UNP Q749D0
A	135	LYS	VAL	engineered mutation	UNP Q749D0
B	134	PRO	SER	engineered mutation	UNP Q749D0
B	135	LYS	VAL	engineered mutation	UNP Q749D0

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

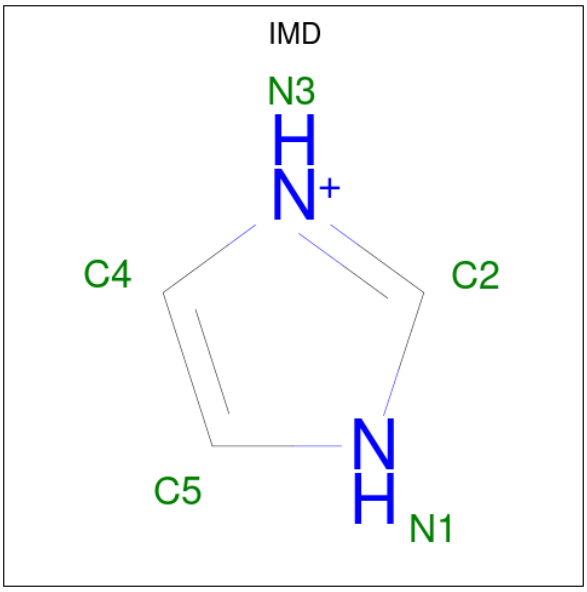


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

- Molecule 4 is IMIDAZOLE (CCD ID: IMD) (formula: $C_3H_5N_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	N	0	0
			5	3	2		
4	B	1	Total	C	N	0	0
			5	3	2		

- Molecule 5 is water.

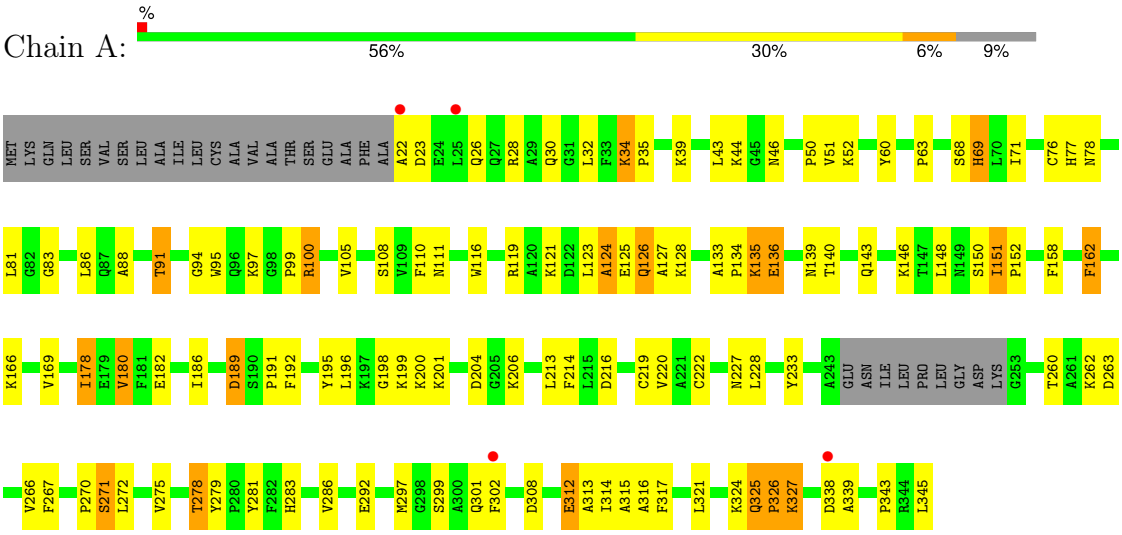
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	70	Total O 70 70	0	0
5	B	74	Total O 74 74	0	0

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.

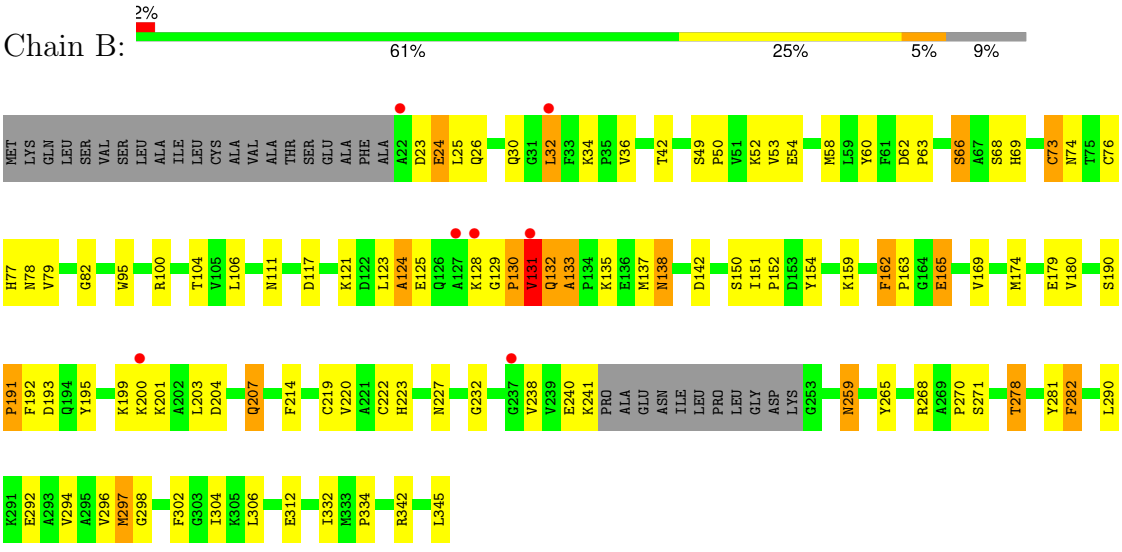
• Molecule 1: Cytochrome c551 peroxidase

Chain A:



• Molecule 1: Cytochrome c551 peroxidase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	56.16Å 89.51Å 75.11Å 90.00° 107.57° 90.00°	Depositor
Resolution (Å)	44.77 – 2.40 44.77 – 2.40	Depositor EDS
% Data completeness (in resolution range)	98.8 (44.77-2.40) 98.7 (44.77-2.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.17	Depositor
$< I/\sigma(I) >$ [1]	1.35 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.229 , 0.324 0.225 , 0.319	Depositor DCC
R_{free} test set	1370 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	38.7	Xtriage
Anisotropy	0.335	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 45.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	5094	wwPDB-VP
Average B, all atoms (Å^2)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.13% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: IMD, CA, 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	0.81	1/2444 (0.0%)	1.11	12/3315 (0.4%)
1	B	0.76	0/2439	1.06	9/3307 (0.3%)
All	All	0.78	1/4883 (0.0%)	1.09	21/6622 (0.3%)

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	0	1
1	B	0	1
All	All	0	2

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	100	ARG	CA-C	5.31	1.59	1.52

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	232	GLY	N-CA-C	7.02	121.39	111.14
1	A	110	PHE	N-CA-C	6.73	121.34	113.20
1	A	325	GLN	CA-C-N	6.56	126.92	119.83
1	A	325	GLN	C-N-CA	6.56	126.92	119.83
1	B	165	GLU	N-CA-C	6.32	119.63	110.28
1	A	189	ASP	N-CA-C	6.30	120.21	111.90
1	B	162	PHE	CA-C-N	5.75	125.28	119.19
1	B	162	PHE	C-N-CA	5.75	125.28	119.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	69	HIS	N-CA-C	-5.61	104.41	111.92
1	A	278	THR	N-CA-C	5.54	119.35	112.59
1	A	162	PHE	CA-C-N	5.52	124.86	118.85
1	A	162	PHE	C-N-CA	5.52	124.86	118.85
1	A	88	ALA	N-CA-C	-5.50	104.98	110.97
1	A	151	ILE	CA-C-N	5.49	126.70	119.84
1	A	151	ILE	C-N-CA	5.49	126.70	119.84
1	A	100	ARG	N-CA-C	5.41	118.04	109.50
1	B	129	GLY	CA-C-N	5.39	126.58	119.84
1	B	129	GLY	C-N-CA	5.39	126.58	119.84
1	B	100	ARG	N-CA-C	5.31	118.06	109.40
1	B	342	ARG	CA-C-N	5.08	125.09	119.90
1	B	342	ARG	C-N-CA	5.08	125.09	119.90

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	126	GLN	Peptide
1	B	130	PRO	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	2385	0	2388	92	0
1	B	2381	0	2382	72	0
2	A	86	0	60	23	0
2	B	86	0	60	23	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	5	0	4	0	0
4	B	5	0	4	0	0
5	A	70	0	0	3	0
5	B	74	0	0	0	0
All	All	5094	0	4898	161	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 16.

All (161) 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:B:219:CYS:SG	2:B:401:HEM:HAB	1.56	1.43
1:A:219:CYS:SG	2:A:401:HEM:HAB	1.63	1.37
1:A:76:CYS:SG	2:A:400:HEM:CAC	2.12	1.36
1:A:219:CYS:SG	2:A:401:HEM:CAB	2.22	1.28
1:B:219:CYS:SG	2:B:401:HEM:CAB	2.23	1.25
1:B:76:CYS:SG	2:B:400:HEM:CBC	2.31	1.18
1:A:222:CYS:SG	2:A:401:HEM:CAC	2.32	1.16
1:A:76:CYS:SG	2:A:400:HEM:HAC	1.89	1.08
1:B:73:CYS:SG	2:B:400:HEM:CAB	2.42	1.06
1:B:76:CYS:SG	2:B:400:HEM:CAC	2.47	1.02
1:B:222:CYS:SG	2:B:401:HEM:CAC	2.47	1.01
1:B:219:CYS:HG	2:B:401:HEM:CAB	1.70	1.00
1:B:222:CYS:HG	2:B:401:HEM:CAC	1.73	1.00
1:A:219:CYS:HG	2:A:401:HEM:HAB	1.18	0.99
1:A:134:PRO:O	1:A:135:LYS:HB2	1.58	0.99
1:A:222:CYS:SG	2:A:401:HEM:HAC	2.12	0.89
1:B:131:VAL:HA	1:B:132:GLN:HB2	1.52	0.89
1:A:127:ALA:HB1	1:A:128:LYS:HA	1.56	0.86
1:B:73:CYS:SG	2:B:400:HEM:HAB	2.16	0.86
1:A:297:MET:HE3	2:A:401:HEM:C4D	2.12	0.84
1:B:297:MET:HG2	2:B:401:HEM:C4B	2.17	0.79
1:A:76:CYS:SG	2:A:400:HEM:CBC	2.70	0.79
1:A:150:SER:HB2	1:A:339:ALA:O	1.85	0.76
1:B:298:GLY:HA3	1:B:306:LEU:HD12	1.68	0.74
1:A:76:CYS:HG	2:A:400:HEM:HAC	1.51	0.73
1:A:108:SER:HA	1:A:111:ASN:ND2	2.05	0.72
1:A:206:LYS:NZ	1:A:312:GLU:HG2	2.05	0.70
1:A:140:THR:H	1:A:143:GLN:NE2	1.89	0.69
1:A:297:MET:HE3	2:A:401:HEM:CHA	2.23	0.68
1:B:117:ASP:HB2	1:B:265:TYR:HE2	1.59	0.66
1:A:95:TRP:HB2	1:B:95:TRP:HB2	1.78	0.66
1:B:60:TYR:CE1	1:B:73:CYS:HB2	2.31	0.65
1:A:108:SER:HA	1:A:111:ASN:HD21	1.62	0.64
1:A:127:ALA:CB	1:A:128:LYS:HA	2.26	0.64
1:B:222:CYS:SG	2:B:401:HEM:C3C	2.89	0.63
1:A:136:GLU:HB2	2:A:400:HEM:HBC2	1.80	0.63
1:A:313:ALA:O	1:A:316:ALA:HB3	1.99	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:63:PRO:O	1:A:69:HIS:HA	1.99	0.62
1:B:292:GLU:O	1:B:296:VAL:HG23	1.99	0.62
1:A:68:SER:O	1:A:69:HIS:HB2	1.98	0.61
1:B:151:ILE:HG21	1:B:334:PRO:HG2	1.83	0.61
1:A:52:LYS:HE2	1:A:162:PHE:CE1	2.35	0.61
1:B:214:PHE:O	1:B:219:CYS:HB2	2.01	0.61
1:A:22:ALA:HB1	5:A:347:HOH:O	2.01	0.61
1:A:76:CYS:SG	2:A:400:HEM:C3C	2.92	0.59
1:A:297:MET:CE	2:A:401:HEM:C4D	2.85	0.59
1:A:228:LEU:HD22	1:A:321:LEU:HD11	1.85	0.58
1:A:178:ILE:O	1:A:182:GLU:HG3	2.03	0.58
1:B:58:MET:O	1:B:62:ASP:HB2	2.02	0.58
1:A:105:VAL:O	1:A:105:VAL:HG22	2.03	0.58
1:A:206:LYS:HZ1	1:A:312:GLU:HG2	1.66	0.58
1:A:52:LYS:HE2	1:A:162:PHE:CZ	2.40	0.57
1:B:282:PHE:CD1	2:B:401:HEM:HBD1	2.39	0.57
1:B:53:VAL:HG22	1:B:180:VAL:HG12	1.86	0.57
1:B:290:LEU:O	1:B:290:LEU:HG	2.03	0.57
1:A:60:TYR:OH	1:A:105:VAL:HG11	2.05	0.57
1:A:222:CYS:SG	2:A:401:HEM:CBC	2.91	0.57
1:A:299:SER:HA	5:A:390:HOH:O	2.05	0.57
1:B:73:CYS:HB3	2:B:400:HEM:C3B	2.41	0.55
1:A:228:LEU:HD22	1:A:321:LEU:CD1	2.37	0.55
1:B:204:ASP:OD1	1:B:207:GLN:HG3	2.07	0.55
1:B:297:MET:HG2	2:B:401:HEM:C3B	2.42	0.54
1:A:69:HIS:CD2	1:A:343:PRO:HG3	2.43	0.54
1:A:28:ARG:O	1:A:32:LEU:HD12	2.07	0.54
1:A:297:MET:O	1:A:299:SER:N	2.41	0.53
1:A:126:GLN:HB3	1:A:127:ALA:CA	2.39	0.53
1:A:192:PHE:CD1	1:A:317:PHE:HE1	2.26	0.53
1:A:169:VAL:HG12	1:A:169:VAL:O	2.08	0.53
1:A:204:ASP:OD1	1:A:204:ASP:C	2.51	0.53
1:A:28:ARG:NH2	1:A:216:ASP:OD1	2.33	0.52
1:B:203:LEU:HB3	1:B:207:GLN:HB2	1.91	0.52
1:A:23:ASP:HB2	1:A:200:LYS:NZ	2.25	0.52
1:A:91:THR:HG21	1:B:345:LEU:HD22	1.91	0.52
1:A:127:ALA:CB	1:A:128:LYS:CA	2.88	0.52
1:B:117:ASP:HB2	1:B:265:TYR:CE2	2.44	0.52
1:A:139:ASN:OD1	1:A:143:GLN:NE2	2.43	0.52
1:B:238:VAL:HG21	1:B:282:PHE:CE1	2.45	0.52
1:A:134:PRO:O	1:A:135:LYS:CB	2.42	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:204:ASP:OD1	1:B:204:ASP:C	2.53	0.51
1:A:297:MET:HG3	2:A:401:HEM:C4A	2.45	0.51
1:B:26:GLN:HE21	1:B:30:GLN:NE2	2.09	0.51
1:B:259[B]:ASN:ND2	1:B:259[B]:ASN:C	2.68	0.51
1:A:195:TYR:HA	1:A:199:LYS:O	2.10	0.51
1:B:26:GLN:HE21	1:B:30:GLN:HE22	1.59	0.50
1:B:282:PHE:HD1	2:B:401:HEM:HBD1	1.76	0.50
1:A:126:GLN:HB3	1:A:127:ALA:HA	1.94	0.50
1:B:222:CYS:SG	2:B:401:HEM:HAC	2.46	0.50
1:B:302:PHE:HB2	1:B:304:ILE:HG13	1.94	0.50
1:A:214:PHE:O	1:A:219:CYS:HB2	2.11	0.50
1:B:223:HIS:HE1	1:B:270:PRO:HD2	1.77	0.50
1:A:99:PRO:O	1:A:100:ARG:HD3	2.12	0.50
1:B:73:CYS:SG	2:B:400:HEM:C3B	3.03	0.49
1:B:214:PHE:CE1	1:B:219:CYS:HB3	2.47	0.49
1:A:46:ASN:ND2	1:A:180:VAL:HG23	2.28	0.49
1:A:219:CYS:SG	2:A:401:HEM:C3B	3.04	0.49
1:A:325:GLN:HB2	1:B:332:ILE:HD13	1.94	0.49
1:B:82:GLY:HA2	1:B:106:LEU:HD11	1.95	0.49
1:A:222:CYS:SG	2:A:401:HEM:C3C	3.03	0.49
1:A:275:VAL:O	1:A:281:TYR:OH	2.29	0.48
1:A:123:LEU:O	1:A:124:ALA:C	2.56	0.48
1:B:77:HIS:CD2	2:B:400:HEM:NB	2.81	0.48
1:B:270:PRO:HG2	2:B:401:HEM:HBA1	1.95	0.48
1:A:78:ASN:HB3	1:A:81:LEU:HB2	1.95	0.47
1:B:150:SER:O	1:B:152:PRO:HD3	2.13	0.47
1:A:119:ARG:HE	1:A:121:LYS:HE3	1.79	0.47
1:B:60:TYR:CD1	1:B:73:CYS:HB2	2.50	0.47
1:B:259[B]:ASN:C	1:B:259[B]:ASN:HD22	2.22	0.47
1:A:270:PRO:HD3	2:A:401:HEM:C3D	2.50	0.47
1:B:52:LYS:HE2	1:B:162:PHE:CE1	2.51	0.46
1:B:76:CYS:SG	2:B:400:HEM:C3C	3.07	0.46
1:B:49:SER:O	1:B:50:PRO:C	2.58	0.46
1:A:26:GLN:O	1:A:30:GLN:HG3	2.15	0.46
1:B:137:MET:HE1	2:B:400:HEM:HAB	1.96	0.46
1:B:32:LEU:HG	1:B:220:VAL:HG21	1.98	0.46
1:B:297:MET:HG2	2:B:401:HEM:NB	2.30	0.46
1:A:116:TRP:CE3	1:A:283:HIS:HB3	2.51	0.46
1:A:297:MET:HG3	2:A:401:HEM:NA	2.32	0.45
1:A:23:ASP:HB2	1:A:200:LYS:HZ2	1.81	0.45
1:B:24:GLU:O	1:B:24:GLU:HG2	2.17	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:74:ASN:OD1	1:B:78:ASN:HA	2.15	0.45
1:B:54:GLU:O	1:B:58:MET:HG3	2.17	0.45
1:B:192:PHE:O	1:B:195:TYR:HB3	2.17	0.45
1:A:123:LEU:HA	1:A:126:GLN:NE2	2.32	0.44
1:B:190:SER:O	1:B:191:PRO:C	2.60	0.44
1:A:260:THR:HG21	1:A:267:PHE:HE2	1.83	0.44
1:B:131:VAL:CA	1:B:132:GLN:HB2	2.36	0.44
1:B:104:THR:HB	1:B:278:THR:HG21	2.00	0.44
1:A:34:LYS:HD3	1:A:35:PRO:HD2	1.99	0.44
1:A:227:ASN:HB3	1:A:271:SER:HB2	1.99	0.44
1:B:238:VAL:HG21	1:B:282:PHE:CZ	2.53	0.44
1:A:151:ILE:HA	1:A:152:PRO:HD2	1.81	0.43
1:A:327:LYS:HD2	1:A:327:LYS:HA	1.94	0.43
1:A:94:GLY:O	1:A:95:TRP:CB	2.67	0.42
1:B:63:PRO:O	1:B:66:SER:OG	2.37	0.42
1:A:63:PRO:HA	1:A:71:ILE:O	2.19	0.42
1:A:272:LEU:HD23	1:A:272:LEU:HA	1.66	0.42
1:A:192:PHE:CE1	1:A:317:PHE:HE1	2.36	0.42
1:B:132:GLN:HG3	1:B:133:ALA:N	2.34	0.42
1:B:111:ASN:OD1	1:B:227:ASN:ND2	2.34	0.42
1:A:213:LEU:HB3	1:A:314:ILE:HD11	2.02	0.42
1:B:138:ASN:O	1:B:138:ASN:ND2	2.43	0.42
1:A:220:VAL:HG22	1:A:220:VAL:O	2.20	0.42
1:A:272:LEU:HD11	2:A:401:HEM:CHB	2.50	0.42
1:A:68:SER:O	1:A:343:PRO:HB3	2.20	0.41
1:A:233:TYR:HB3	1:A:266:VAL:HB	2.02	0.41
1:B:123:LEU:O	1:B:124:ALA:C	2.64	0.41
1:B:159:LYS:O	1:B:163:PRO:HA	2.20	0.41
1:A:270:PRO:HG2	2:A:401:HEM:CBA	2.51	0.41
1:B:76:CYS:SG	2:B:400:HEM:HBC2	2.47	0.41
1:B:281:TYR:O	1:B:282:PHE:HB2	2.21	0.41
1:A:297:MET:HB3	2:A:401:HEM:C4B	2.56	0.41
1:A:77:HIS:HA	1:A:83:GLY:O	2.20	0.41
1:A:133:ALA:HB1	1:A:136:GLU:HG2	2.03	0.41
1:A:148:LEU:HD22	1:A:158:PHE:HE2	1.86	0.41
1:A:192:PHE:CE2	1:A:196:LEU:HD11	2.56	0.41
1:B:36:VAL:HG23	1:B:193:ASP:OD2	2.21	0.41
1:A:325:GLN:HA	1:A:326:PRO:HD3	1.94	0.41
1:A:200:LYS:HE3	5:A:348:HOH:O	2.21	0.40
1:A:314:ILE:O	1:A:315:ALA:C	2.64	0.40
1:B:68:SER:O	1:B:69:HIS:HB2	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:290:LEU:O	1:B:294:VAL:HG23	2.21	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	311/345 (90%)	271 (87%)	34 (11%)	6 (2%)	6 8
1	B	310/345 (90%)	277 (89%)	25 (8%)	8 (3%)	4 4
All	All	621/690 (90%)	548 (88%)	59 (10%)	14 (2%)	5 6

All (14) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	124	ALA
1	A	135	LYS
1	B	130	PRO
1	B	131	VAL
1	B	132	GLN
1	A	198	GLY
1	B	124	ALA
1	B	169	VAL
1	B	282	PHE
1	B	191	PRO
1	A	191	PRO
1	A	50	PRO
1	A	279	TYR
1	B	133	ALA

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	252/276 (91%)	220 (87%)	32 (13%)	3 4
1	B	252/276 (91%)	219 (87%)	33 (13%)	3 4
All	All	504/552 (91%)	439 (87%)	65 (13%)	3 4

All (65) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	LYS
1	A	39	LYS
1	A	43	LEU
1	A	44	LYS
1	A	51	VAL
1	A	86	LEU
1	A	91	THR
1	A	97	LYS
1	A	125	GLU
1	A	136	GLU
1	A	146	LYS
1	A	166	LYS
1	A	178	ILE
1	A	180	VAL
1	A	186	ILE
1	A	189	ASP
1	A	201	LYS
1	A	262	LYS
1	A	263	ASP
1	A	271	SER
1	A	278	THR
1	A	286	VAL
1	A	292	GLU
1	A	301	GLN
1	A	302	PHE
1	A	308	ASP
1	A	312	GLU

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Mol	Chain	Res	Type
1	A	324	LYS
1	A	326	PRO
1	A	327	LYS
1	A	338	ASP
1	A	345	LEU
1	B	23	ASP
1	B	24	GLU
1	B	25	LEU
1	B	32	LEU
1	B	34	LYS
1	B	42	THR
1	B	66	SER
1	B	73	CYS
1	B	79	VAL
1	B	121	LYS
1	B	125	GLU
1	B	128	LYS
1	B	131	VAL
1	B	135	LYS
1	B	138	ASN
1	B	142	ASP
1	B	154	TYR
1	B	165	GLU
1	B	174	MET
1	B	179	GLU
1	B	199	LYS
1	B	200	LYS
1	B	201	LYS
1	B	207	GLN
1	B	240	GLU
1	B	241	LYS
1	B	259[A]	ASN
1	B	259[B]	ASN
1	B	268	ARG
1	B	271	SER
1	B	278	THR
1	B	297	MET
1	B	312	GLU

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	69	HIS
1	A	107	ASN
1	A	126	GLN
1	A	138	ASN
1	A	143	GLN
1	A	149	ASN
1	A	194	GLN
1	A	301	GLN
1	A	325	GLN
1	B	26	GLN
1	B	107	ASN
1	B	173	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

Of 8 ligands modelled in this entry, 2 are monoatomic - leaving 6 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	$\#\|Z\| > 2$
4	IMD	A	346	2	3,5,5	0.29	0	4,5,5	0.46	0
2	HEM	A	401	1	42,50,50	2.08	10 (23%)	46,82,82	1.73	9 (19%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
2	HEM	B	401	1	42,50,50	1.93	7 (16%)	46,82,82	1.74	12 (26%)
4	IMD	B	346	2	3,5,5	0.43	0	4,5,5	0.61	0
2	HEM	B	400	4,1	42,50,50	1.94	7 (16%)	46,82,82	1.50	8 (17%)
2	HEM	A	400	4,1	42,50,50	2.06	11 (26%)	46,82,82	1.87	10 (21%)

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
4	IMD	A	346	2	-	-	0/1/1/1
2	HEM	A	401	1	-	7/12/54/54	-
2	HEM	B	401	1	-	6/12/54/54	-
4	IMD	B	346	2	-	-	0/1/1/1
2	HEM	B	400	4,1	-	6/12/54/54	-
2	HEM	A	400	4,1	-	4/12/54/54	-

All (35) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	HEM	C3D-C2D	8.34	1.54	1.36
2	B	400	HEM	C3D-C2D	8.00	1.54	1.36
2	A	400	HEM	C3D-C2D	7.69	1.53	1.36
2	B	401	HEM	C3D-C2D	7.43	1.52	1.36
2	A	401	HEM	C3C-C2C	-4.43	1.34	1.40
2	A	400	HEM	C3C-C2C	-4.40	1.34	1.40
2	B	401	HEM	C3C-C2C	-3.96	1.35	1.40
2	B	400	HEM	C3C-CAC	3.93	1.56	1.47
2	B	401	HEM	C3C-CAC	3.88	1.56	1.47
2	A	400	HEM	C3C-CAC	3.86	1.56	1.47
2	B	400	HEM	CAB-C3B	3.70	1.57	1.47
2	A	401	HEM	C3C-CAC	3.70	1.56	1.47
2	A	400	HEM	CMB-C2B	3.27	1.57	1.50
2	A	400	HEM	CAB-C3B	3.20	1.55	1.47
2	B	400	HEM	C3C-C2C	-3.08	1.36	1.40
2	A	401	HEM	CAB-C3B	3.01	1.55	1.47
2	B	401	HEM	FE-ND	2.96	2.14	1.98
2	A	401	HEM	C3C-C4C	2.79	1.45	1.41
2	B	401	HEM	CAB-C3B	2.59	1.54	1.47
2	A	400	HEM	C3C-C4C	2.54	1.45	1.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	400	HEM	CMA-C3A	2.43	1.56	1.51
2	A	400	HEM	C4A-NA	2.41	1.41	1.36
2	B	401	HEM	C3C-C4C	2.40	1.44	1.41
2	B	400	HEM	CMB-C2B	2.35	1.55	1.50
2	A	400	HEM	FE-ND	2.33	2.11	1.98
2	A	401	HEM	CMA-C3A	2.31	1.56	1.51
2	A	401	HEM	CMB-C2B	2.30	1.55	1.50
2	A	401	HEM	CMD-C2D	2.28	1.55	1.50
2	B	401	HEM	CMD-C2D	2.25	1.55	1.50
2	B	400	HEM	FE-ND	2.22	2.10	1.98
2	A	401	HEM	CHA-C4D	2.14	1.39	1.34
2	A	400	HEM	O1A-CGA	2.10	1.29	1.22
2	A	400	HEM	CHA-C4D	2.08	1.39	1.34
2	B	400	HEM	CMD-C2D	2.07	1.55	1.50
2	A	401	HEM	O1A-CGA	2.02	1.28	1.22

All (39) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	400	HEM	C4D-ND-C1D	5.60	111.83	105.21
2	A	401	HEM	C4D-ND-C1D	5.22	111.39	105.21
2	A	401	HEM	CBD-CAD-C3D	-4.77	99.36	112.53
2	B	400	HEM	C4D-ND-C1D	4.71	110.79	105.21
2	A	400	HEM	C4C-CHD-C1D	4.69	128.74	122.56
2	A	400	HEM	CAA-CBA-CGA	-4.30	102.25	113.83
2	B	401	HEM	C4C-CHD-C1D	4.21	128.11	122.56
2	B	401	HEM	CBA-CAA-C2A	-4.16	105.55	112.54
2	B	401	HEM	C4D-ND-C1D	3.73	109.62	105.21
2	B	401	HEM	C3B-C2B-C1B	3.43	108.99	106.41
2	A	400	HEM	C4B-CHC-C1C	-3.27	118.25	122.56
2	B	401	HEM	CAD-C3D-C4D	3.02	129.95	124.70
2	A	400	HEM	CBD-CAD-C3D	-2.79	104.81	112.53
2	A	401	HEM	CHD-C1D-ND	2.74	127.38	124.44
2	B	400	HEM	C3B-C2B-C1B	2.73	108.46	106.41
2	B	401	HEM	C1B-NB-C4B	2.71	108.42	105.21
2	A	401	HEM	CBA-CAA-C2A	-2.70	108.00	112.54
2	B	400	HEM	CMC-C2C-C3C	2.67	130.02	124.68
2	A	401	HEM	C4B-CHC-C1C	2.67	126.08	122.56
2	A	401	HEM	CHC-C4B-C3B	2.57	128.50	124.57
2	A	401	HEM	C3D-C4D-ND	-2.55	107.37	110.17
2	A	400	HEM	CMA-C3A-C4A	-2.54	124.73	128.46
2	B	400	HEM	CMA-C3A-C4A	-2.54	124.74	128.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	400	HEM	CHC-C4B-C3B	2.49	128.38	124.57
2	A	401	HEM	C1D-C2D-C3D	-2.45	104.40	106.98
2	B	401	HEM	C4A-C3A-C2A	2.42	108.68	107.00
2	B	401	HEM	CMD-C2D-C1D	2.41	128.80	125.03
2	A	400	HEM	CBA-CAA-C2A	-2.41	108.49	112.54
2	B	400	HEM	C1B-NB-C4B	2.36	108.00	105.21
2	A	401	HEM	CMA-C3A-C4A	-2.34	125.02	128.46
2	A	400	HEM	C1B-NB-C4B	2.31	107.95	105.21
2	B	401	HEM	O1A-CGA-CBA	-2.27	115.90	123.09
2	B	401	HEM	C2B-C1B-NB	-2.27	107.23	109.84
2	A	400	HEM	CAD-C3D-C4D	2.23	128.59	124.70
2	B	401	HEM	O2A-CGA-CBA	2.18	120.88	114.00
2	B	400	HEM	CAD-C3D-C4D	2.16	128.46	124.70
2	B	400	HEM	O1A-CGA-CBA	-2.11	116.40	123.09
2	B	400	HEM	CHC-C4B-C3B	2.05	127.70	124.57
2	B	401	HEM	CMA-C3A-C4A	-2.04	125.46	128.46

There are no chirality outliers.

All (23) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	400	HEM	C2B-C3B-CAB-CBB
2	A	401	HEM	C1A-C2A-CAA-CBA
2	A	401	HEM	C3A-C2A-CAA-CBA
2	A	401	HEM	C2B-C3B-CAB-CBB
2	B	400	HEM	C2A-CAA-CBA-CGA
2	A	401	HEM	C4B-C3B-CAB-CBB
2	B	401	HEM	C2B-C3B-CAB-CBB
2	A	400	HEM	C4B-C3B-CAB-CBB
2	A	401	HEM	C2A-CAA-CBA-CGA
2	B	401	HEM	CAD-CBD-CGD-O2D
2	B	401	HEM	C4B-C3B-CAB-CBB
2	B	401	HEM	CAD-CBD-CGD-O1D
2	A	401	HEM	CAA-CBA-CGA-O2A
2	A	401	HEM	CAA-CBA-CGA-O1A
2	A	400	HEM	CAD-CBD-CGD-O1D
2	A	400	HEM	CAD-CBD-CGD-O2D
2	B	400	HEM	CAD-CBD-CGD-O1D
2	B	400	HEM	C3D-CAD-CBD-CGD
2	B	400	HEM	CAD-CBD-CGD-O2D
2	B	400	HEM	CAA-CBA-CGA-O2A
2	B	400	HEM	CAA-CBA-CGA-O1A

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Mol	Chain	Res	Type	Atoms
2	B	401	HEM	CAA-CBA-CGA-O1A
2	B	401	HEM	CAA-CBA-CGA-O2A

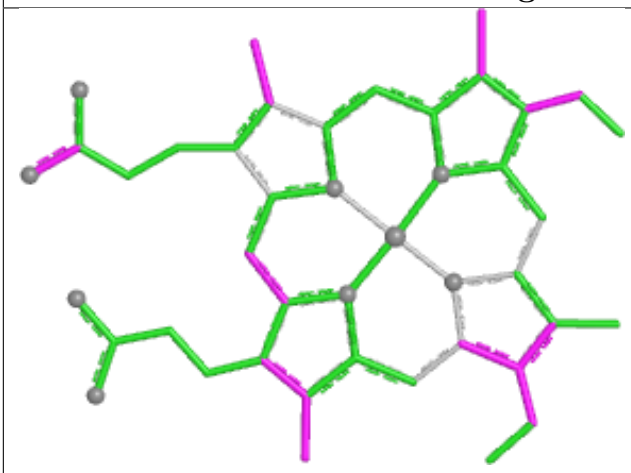
There are no ring outliers.

4 monomers are involved in 46 short contacts:

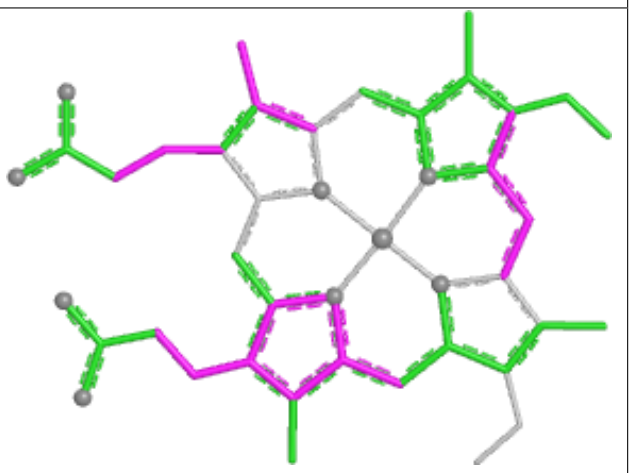
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	HEM	17	0
2	B	401	HEM	13	0
2	B	400	HEM	10	0
2	A	400	HEM	6	0

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 then 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.

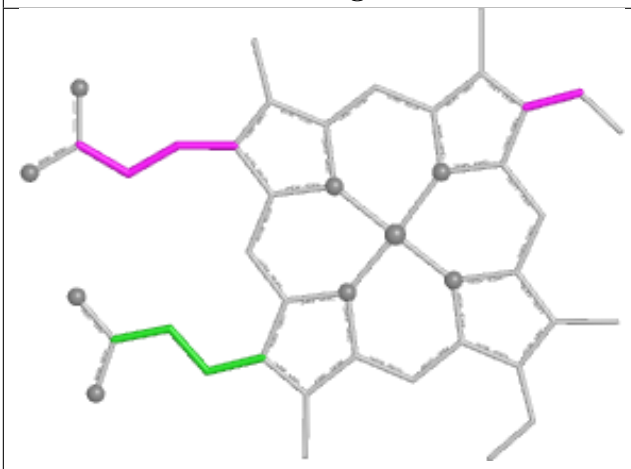
Ligand HEM A 401



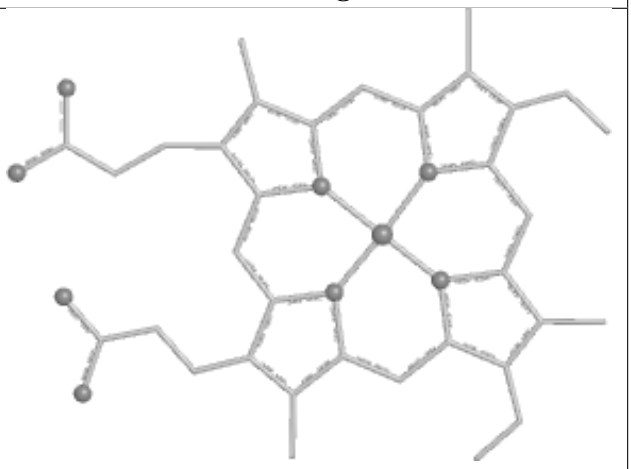
Bond lengths



Bond angles

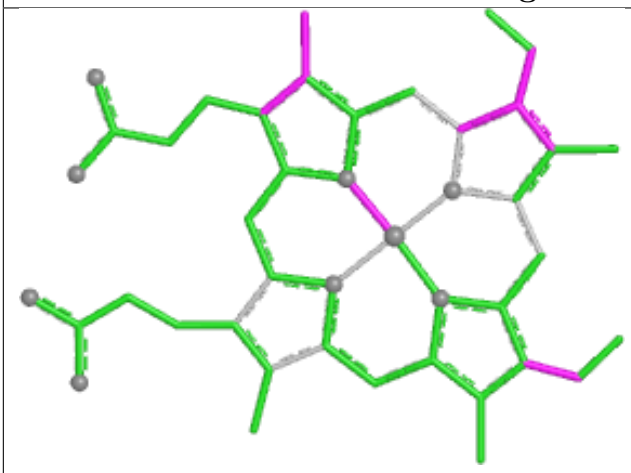


Torsions

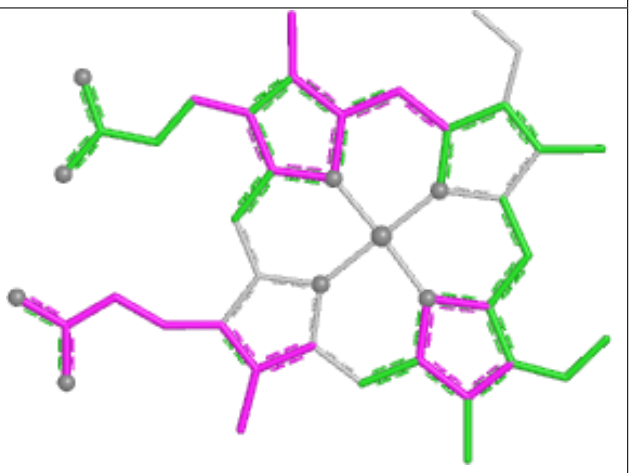


Rings

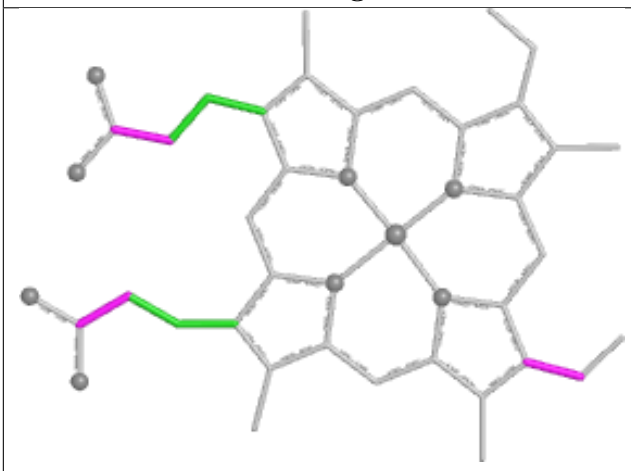
Ligand HEM B 401



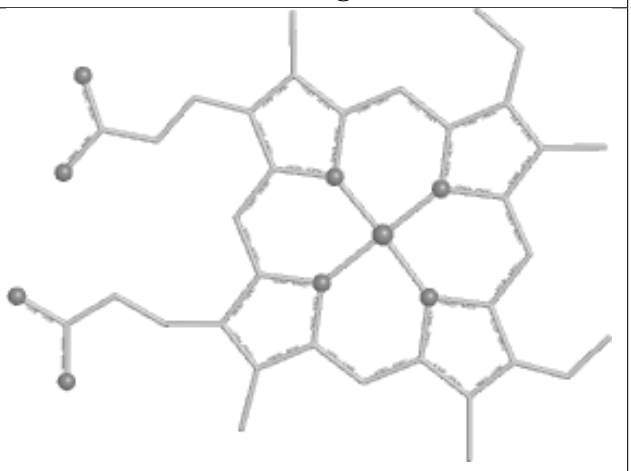
Bond lengths



Bond angles

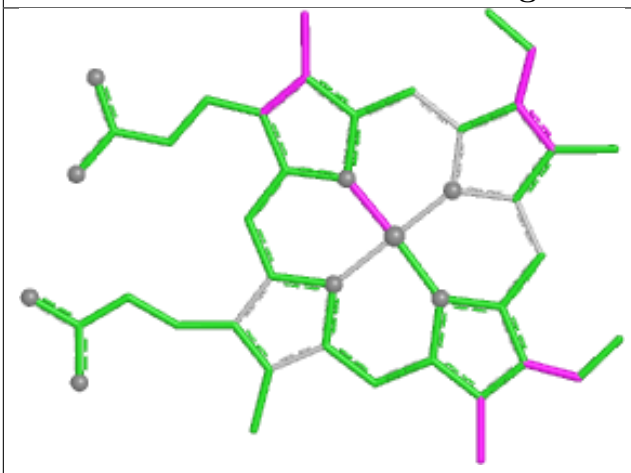


Torsions

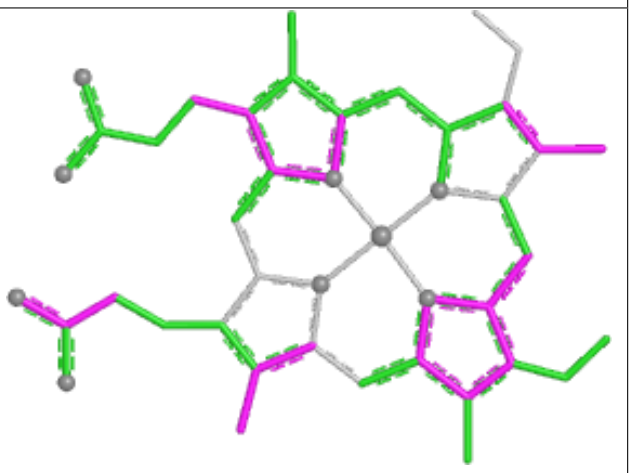


Rings

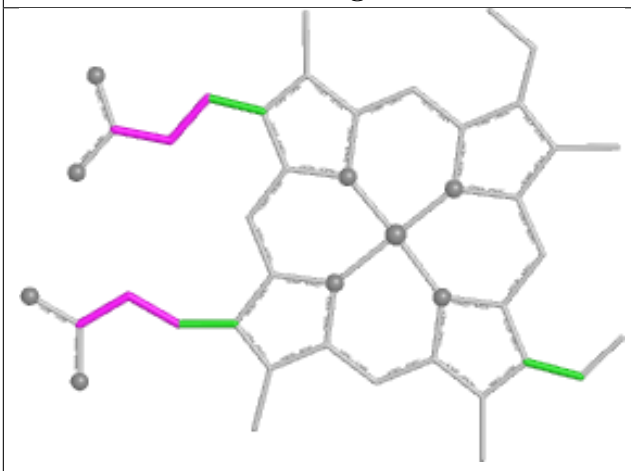
Ligand HEM B 400



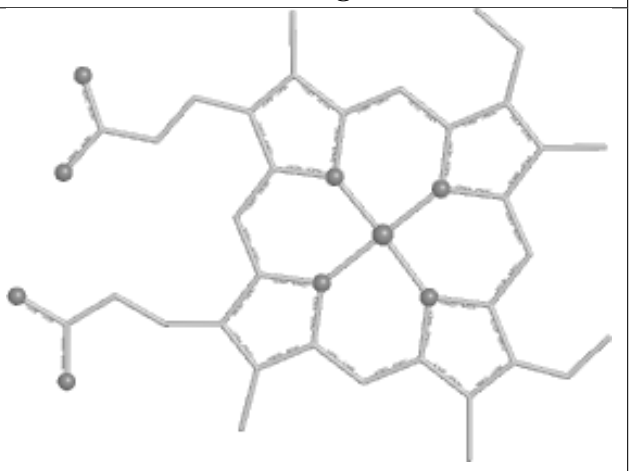
Bond lengths



Bond angles

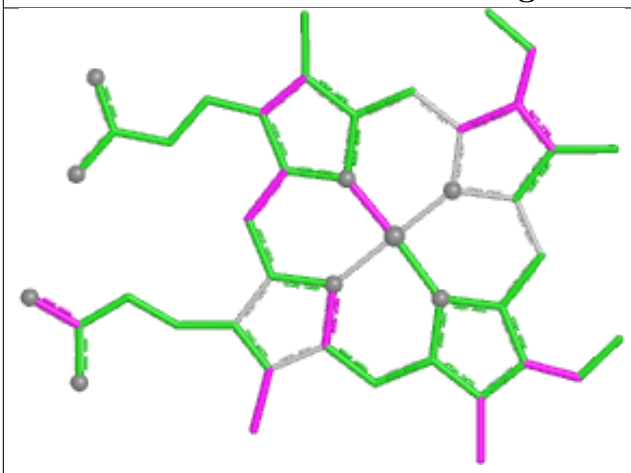


Torsions

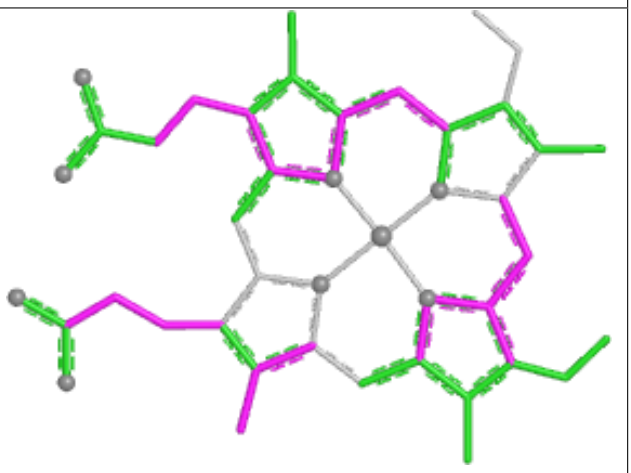


Rings

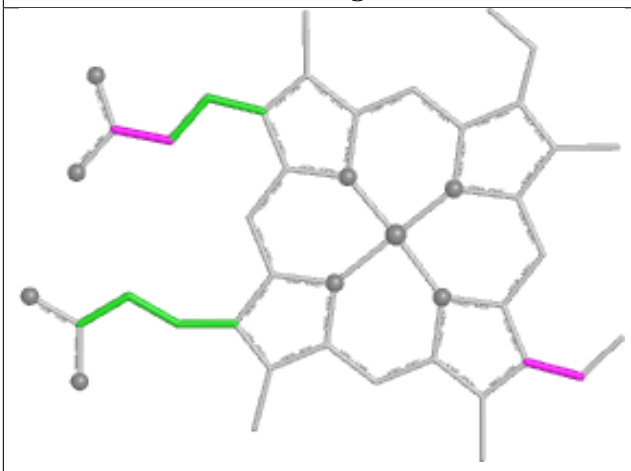
Ligand HEM A 400



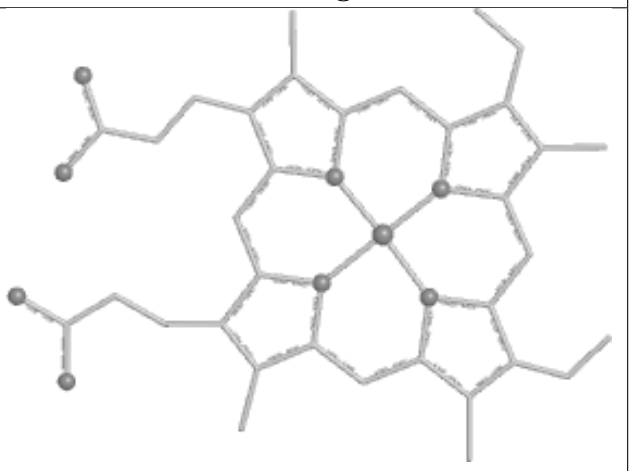
Bond lengths



Bond angles



Torsions



Rings

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, 95^{th} 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	315/345 (91%)	-0.05	4 (1%)	74	71	19, 40, 58, 74	0
1	B	313/345 (90%)	0.11	7 (2%)	62	59	22, 40, 72, 83	1 (0%)
All	All	628/690 (91%)	0.03	11 (1%)	67	63	19, 40, 66, 83	1 (0%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	127	ALA	4.4
1	B	128	LYS	3.1
1	B	22	ALA	2.9
1	B	131	VAL	2.6
1	A	25	LEU	2.4
1	A	338	ASP	2.4
1	A	22	ALA	2.2
1	B	200	LYS	2.1
1	B	32	LEU	2.1
1	B	237	GLY	2.1
1	A	302	PHE	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 monosaccharides in this entry.

6.4 Ligands (i)

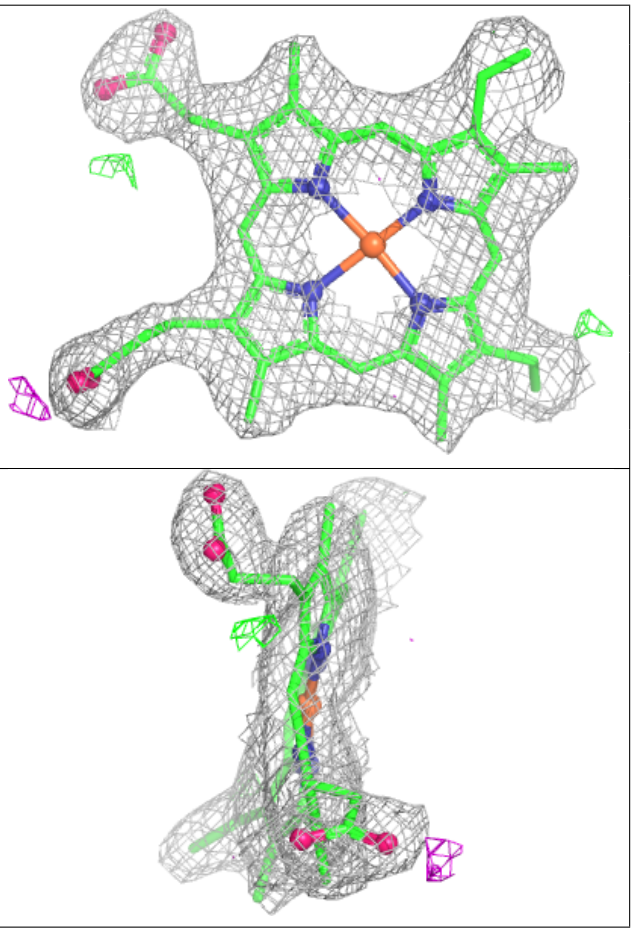
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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	CA	B	402	1/1	0.95	0.06	37,37,37,37	0
4	IMD	B	346	5/5	0.95	0.08	40,40,42,42	0
2	HEM	B	400	43/43	0.96	0.09	24,34,43,48	0
2	HEM	B	401	43/43	0.96	0.09	27,38,40,40	0
2	HEM	A	400	43/43	0.96	0.08	15,25,31,33	0
4	IMD	A	346	5/5	0.96	0.10	26,26,27,27	0
2	HEM	A	401	43/43	0.96	0.08	20,31,33,33	0
3	CA	A	402	1/1	0.98	0.04	31,31,31,31	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.

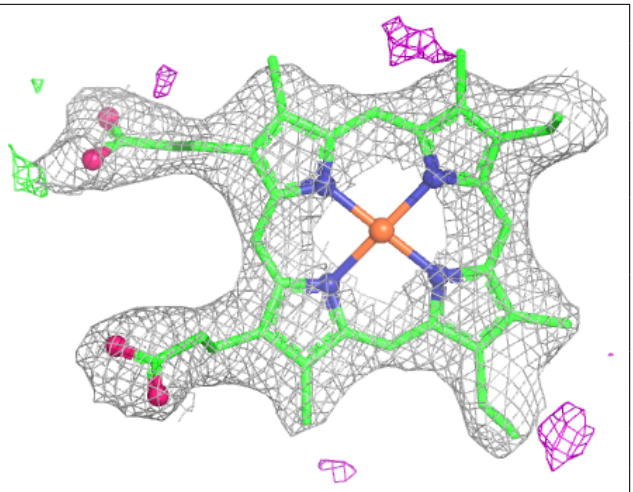
Electron density around HEM B 400:

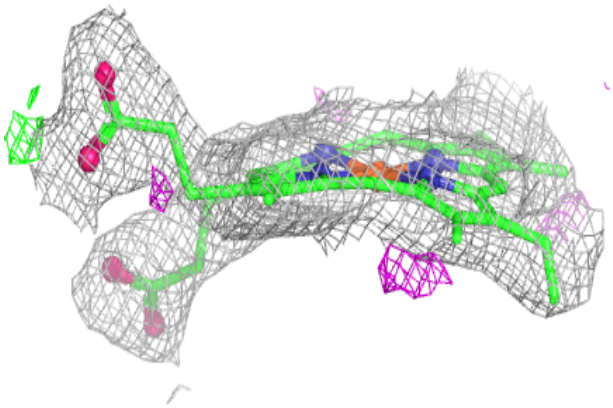
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

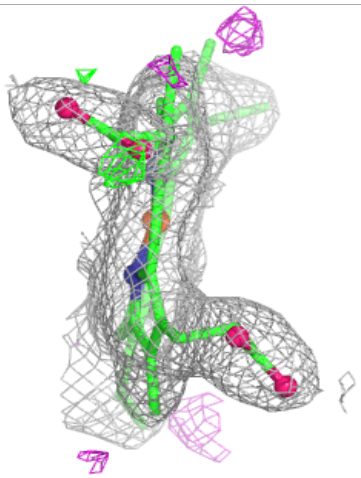


Electron density around HEM B 401:

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

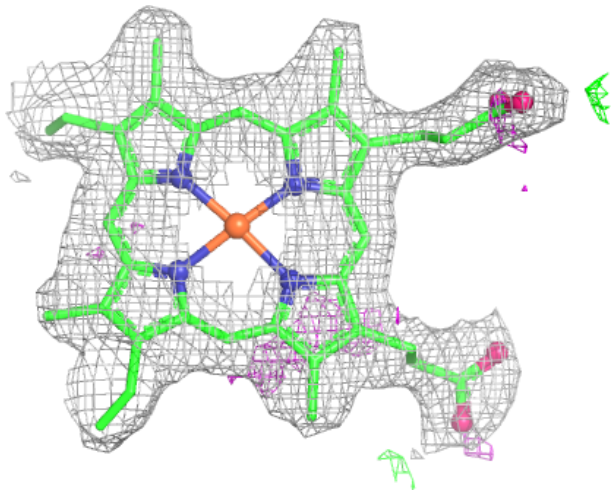


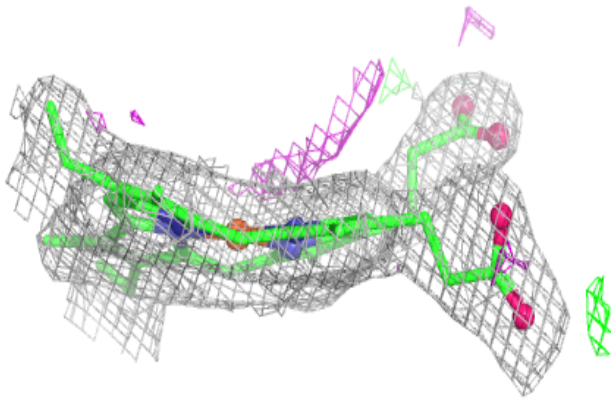


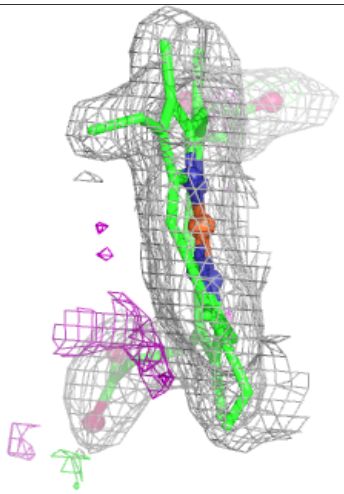


Electron density around HEM A 400:

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

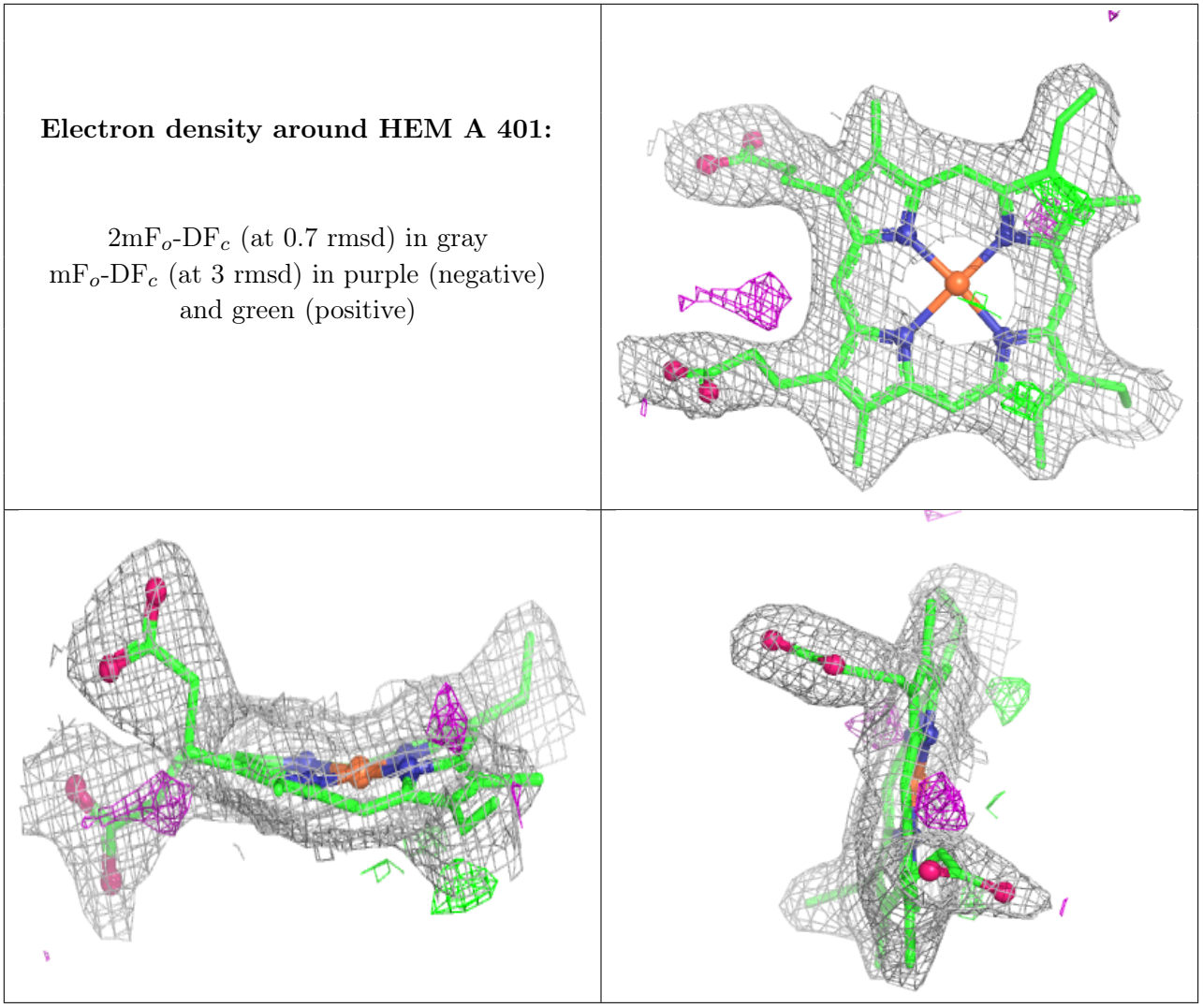






Electron density around HEM A 401:

$2mF_o$-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

There are no such residues in this entry.