



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 24, 2026 – 02:38 PM JST

PDB ID : 9XOH / pdb\_00009xoh  
Title : Crystal Structure of Redesigned HasAsm Variant (14-mutation) with Iron  
Tetraphenylporphyrin  
Authors : Kim, S.; Sugimoto, H.; Shoji, O.  
Deposited on : 2025-11-13  
Resolution : 1.51 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>.

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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 : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.48.1

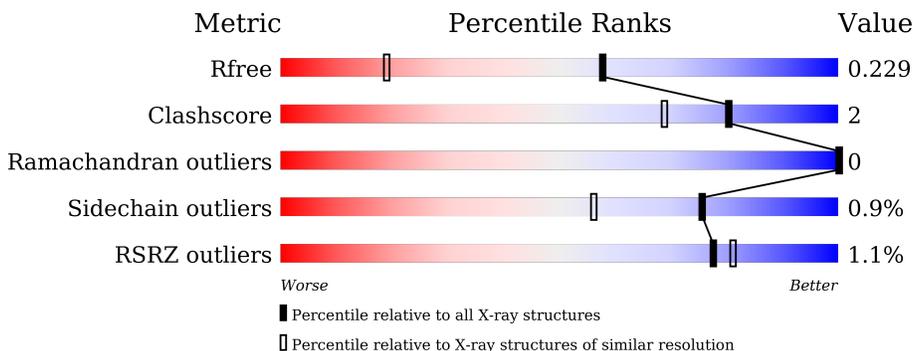
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.51 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	5293 (1.54-1.50)
Clashscore	180529	5759 (1.54-1.50)
Ramachandran outliers	177936	5653 (1.54-1.50)
Sidechain outliers	177891	5650 (1.54-1.50)
RSRZ outliers	164620	5293 (1.54-1.50)

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	176	 2% 92% 7% .
1	B	176	 95% 5%
1	C	176	 95% . .
1	D	176	 92% 6% . .

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 11181 atoms, of which 5064 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 Hemophore HasA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
1	A	176	2604	836	1260	214	292	2	67	19	0
1	B	176	2591	832	1248	215	294	2	68	16	0
1	C	173	2484	803	1193	206	280	2	62	8	0
1	D	173	2487	803	1195	207	280	2	63	9	0

There are 56 discrepancies between the modelled and reference sequences:

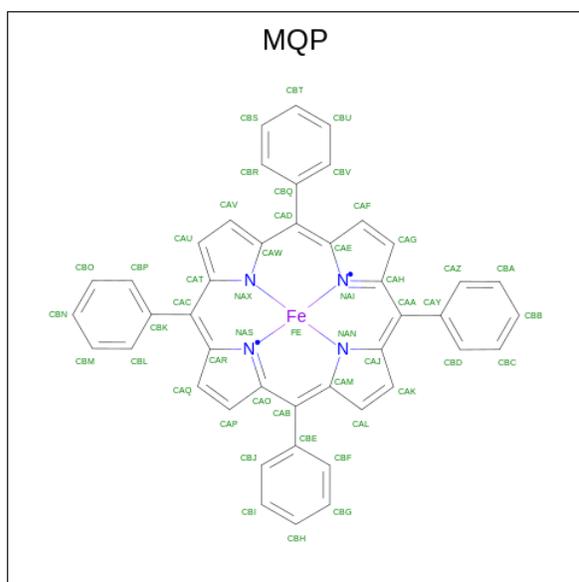
Chain	Residue	Modelled	Actual	Comment	Reference
A	2	SER	ALA	engineered mutation	UNP Q54450
A	13	ALA	GLY	engineered mutation	UNP Q54450
A	17	ALA	HIS	engineered mutation	UNP Q54450
A	21	THR	GLY	engineered mutation	UNP Q54450
A	42	THR	SER	engineered mutation	UNP Q54450
A	63	ASN	GLN	engineered mutation	UNP Q54450
A	79	SER	ASN	engineered mutation	UNP Q54450
A	102	THR	ASP	engineered mutation	UNP Q54450
A	110	ASN	VAL	engineered mutation	UNP Q54450
A	112	GLU	ASP	engineered mutation	UNP Q54450
A	125	SER	ALA	engineered mutation	UNP Q54450
A	131	GLU	VAL	engineered mutation	UNP Q54450
A	145	SER	GLY	engineered mutation	UNP Q54450
A	156	LYS	ASP	engineered mutation	UNP Q54450
B	2	SER	ALA	engineered mutation	UNP Q54450
B	13	ALA	GLY	engineered mutation	UNP Q54450
B	17	ALA	HIS	engineered mutation	UNP Q54450
B	21	THR	GLY	engineered mutation	UNP Q54450
B	42	THR	SER	engineered mutation	UNP Q54450
B	63	ASN	GLN	engineered mutation	UNP Q54450
B	79	SER	ASN	engineered mutation	UNP Q54450

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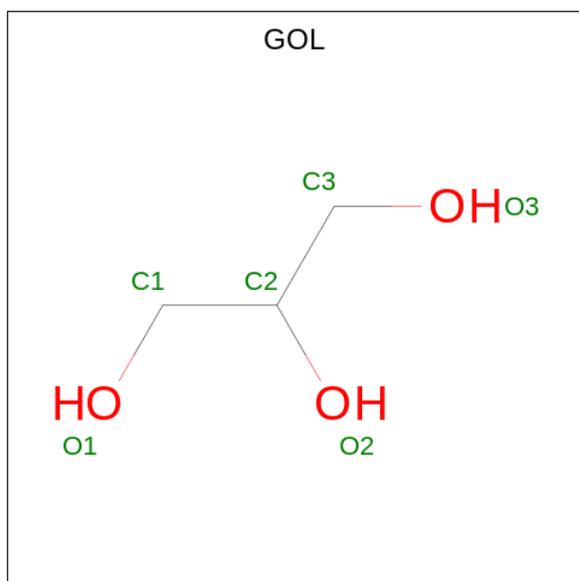
Chain	Residue	Modelled	Actual	Comment	Reference
B	102	THR	ASP	engineered mutation	UNP Q54450
B	110	ASN	VAL	engineered mutation	UNP Q54450
B	112	GLU	ASP	engineered mutation	UNP Q54450
B	125	SER	ALA	engineered mutation	UNP Q54450
B	131	GLU	VAL	engineered mutation	UNP Q54450
B	145	SER	GLY	engineered mutation	UNP Q54450
B	156	LYS	ASP	engineered mutation	UNP Q54450
C	2	SER	ALA	engineered mutation	UNP Q54450
C	13	ALA	GLY	engineered mutation	UNP Q54450
C	17	ALA	HIS	engineered mutation	UNP Q54450
C	21	THR	GLY	engineered mutation	UNP Q54450
C	42	THR	SER	engineered mutation	UNP Q54450
C	63	ASN	GLN	engineered mutation	UNP Q54450
C	79	SER	ASN	engineered mutation	UNP Q54450
C	102	THR	ASP	engineered mutation	UNP Q54450
C	110	ASN	VAL	engineered mutation	UNP Q54450
C	112	GLU	ASP	engineered mutation	UNP Q54450
C	125	SER	ALA	engineered mutation	UNP Q54450
C	131	GLU	VAL	engineered mutation	UNP Q54450
C	145	SER	GLY	engineered mutation	UNP Q54450
C	156	LYS	ASP	engineered mutation	UNP Q54450
D	2	SER	ALA	engineered mutation	UNP Q54450
D	13	ALA	GLY	engineered mutation	UNP Q54450
D	17	ALA	HIS	engineered mutation	UNP Q54450
D	21	THR	GLY	engineered mutation	UNP Q54450
D	42	THR	SER	engineered mutation	UNP Q54450
D	63	ASN	GLN	engineered mutation	UNP Q54450
D	79	SER	ASN	engineered mutation	UNP Q54450
D	102	THR	ASP	engineered mutation	UNP Q54450
D	110	ASN	VAL	engineered mutation	UNP Q54450
D	112	GLU	ASP	engineered mutation	UNP Q54450
D	125	SER	ALA	engineered mutation	UNP Q54450
D	131	GLU	VAL	engineered mutation	UNP Q54450
D	145	SER	GLY	engineered mutation	UNP Q54450
D	156	LYS	ASP	engineered mutation	UNP Q54450

- Molecule 2 is [5,10,15,20-tetraphenylporphyrinato(2-)-kappa 4 N 21 ,N 22 ,N 23 ,N 24 ]iron (CCD ID: MQP) (formula: C<sub>44</sub>H<sub>28</sub>FeN<sub>4</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Fe	H			N
2	A	1	77	44	1	28	4	0	0
2	B	1	77	44	1	28	4	0	0
2	C	1	77	44	1	28	4	0	0
2	D	1	77	44	1	28	4	0	0

- Molecule 3 is GLYCEROL (CCD ID: GOL) (formula:  $C_3H_8O_3$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	H	O	3	0
			14	3	8	3		
3	A	1	Total	C	H	O	3	0
			14	3	8	3		
3	A	1	Total	C	H	O	3	0
			14	3	8	3		
3	B	1	Total	C	H	O	3	0
			14	3	8	3		
3	B	1	Total	C	H	O	3	0
			14	3	8	3		
3	D	1	Total	C	H	O	3	0
			14	3	8	3		
3	D	1	Total	C	H	O	3	0
			14	3	8	3		

- Molecule 4 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	4	Total	Na	0	0
			4	4		
4	B	4	Total	Na	0	0
			4	4		
4	C	2	Total	Na	0	0
			2	2		
4	D	3	Total	Na	0	0
			3	3		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	127	Total	O	0	0
			127	127		
5	B	159	Total	O	0	0
			159	159		
5	C	147	Total	O	0	0
			147	147		
5	D	163	Total	O	0	0
			163	163		

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

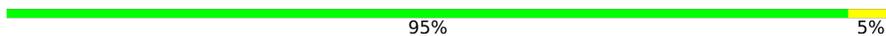
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Hemophore HasA

Chain A: 



- Molecule 1: Hemophore HasA

Chain B: 



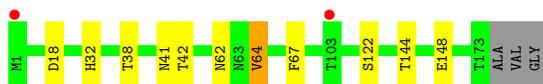
- Molecule 1: Hemophore HasA

Chain C: 



- Molecule 1: Hemophore HasA

Chain D: 



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	71.27Å 65.36Å 74.78Å 90.00° 107.79° 90.00°	Depositor
Resolution (Å)	47.10 – 1.51 47.10 – 1.51	Depositor EDS
% Data completeness (in resolution range)	98.9 (47.10-1.51) 98.8 (47.10-1.51)	Depositor EDS
$R_{merge}$	0.24	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.84 (at 1.51Å)	Xtrriage
Refinement program	REFMAC 5.8.0430 (refmacat 0.4.100)	Depositor
R, $R_{free}$	0.201 , 0.234 0.196 , 0.229	Depositor DCC
$R_{free}$ test set	4988 reflections (4.86%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	10.4	Xtrriage
Anisotropy	1.085	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.43 , 33.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtrriage
Estimated twinning fraction	0.000 for l,-k,h	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	11181	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	13.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 54.47 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 3.6335e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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: NA, MQP, 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	0.59	0/1444	0.99	3/1963 (0.2%)
1	B	0.64	2/1418 (0.1%)	0.96	0/1934
1	C	0.63	0/1351	1.00	0/1842
1	D	0.63	0/1352	1.02	1/1843 (0.1%)
All	All	0.62	2/5565 (0.0%)	0.99	4/7582 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	104[A]	SER	CA-CB	-5.06	1.46	1.54
1	B	104[B]	SER	CA-CB	-5.06	1.46	1.54

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	29	ASP	CA-CB-CG	6.17	118.77	112.60
1	D	67	PHE	CA-CB-CG	5.87	119.67	113.80
1	A	18	ASP	CA-CB-CG	5.59	118.19	112.60
1	A	166	PHE	CA-CB-CG	-5.10	108.70	113.80

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts i

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1344	1260	1190	11	0
1	B	1343	1248	1200	6	0
1	C	1291	1193	1162	5	0
1	D	1292	1195	1158	5	0
2	A	49	28	0	1	0
2	B	49	28	0	0	0
2	C	49	28	0	0	0
2	D	49	28	0	0	0
3	A	18	24	24	2	0
3	B	12	16	16	0	0
3	D	12	16	16	0	0
4	A	4	0	0	0	0
4	B	4	0	0	0	0
4	C	2	0	0	0	0
4	D	3	0	0	0	0
5	A	127	0	0	3	0
5	B	159	0	0	4	0
5	C	147	0	0	3	0
5	D	163	0	0	1	0
All	All	6117	5064	4766	26	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 2.

All (26) 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:D:32:HIS:HD2	1:D:41:ASN:O	1.82	0.61
1:A:6:ASN:HB3	1:B:103[A]:THR:HG22	1.84	0.59
1:D:144:THR:OG1	1:D:148:GLU:OE2	2.17	0.56
1:B:110[B]:ASN:OD1	5:B:301:HOH:O	2.18	0.54
1:A:93[A]:SER:OG	1:A:108[A]:ILE:HD12	2.08	0.53
1:C:61:ALA:N	5:C:307:HOH:O	2.42	0.52
1:A:142:GLY:HA2	5:A:318:HOH:O	2.10	0.51
1:D:18:ASP:OD2	5:D:301:HOH:O	2.19	0.51
1:A:102[A]:THR:HG23	5:A:373:HOH:O	2.10	0.50
1:D:62:ASN:O	1:D:64:VAL:HG12	2.14	0.47
1:C:18:ASP:OD2	5:C:301:HOH:O	2.20	0.47
1:B:102[A]:THR:HG23	5:B:399:HOH:O	2.16	0.46
1:A:114[A]:SER:HB3	1:B:103[A]:THR:O	2.16	0.45
1:A:32:HIS:CD2	2:A:201:MQP:NAX	2.85	0.45
1:A:107[A]:SER:HB3	1:B:107:SER:HB3	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:102[A]:THR:OG1	5:A:301:HOH:O	2.08	0.44
3:A:203:GOL:C3	5:B:331:HOH:O	2.66	0.44
1:C:160:LEU:HD11	1:C:172:ALA:HB2	2.00	0.44
1:A:160[A]:LEU:HD22	1:A:164:SER:OG	2.19	0.43
1:A:99:SER:OG	1:A:107[A]:SER:OG	2.31	0.42
1:A:93[A]:SER:O	1:A:108[A]:ILE:HD11	2.20	0.41
1:C:160:LEU:HD11	1:C:172:ALA:CB	2.50	0.41
1:C:119:ASN:ND2	5:C:309:HOH:O	2.54	0.41
1:B:170:ALA:HB1	1:B:175:VAL:HG23	2.03	0.41
3:A:203:GOL:H31	5:B:331:HOH:O	2.21	0.40
1:D:38:THR:O	1:D:42:THR:HG23	2.20	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	192/176 (109%)	185 (96%)	7 (4%)	0	100	100
1	B	190/176 (108%)	182 (96%)	8 (4%)	0	100	100
1	C	179/176 (102%)	175 (98%)	4 (2%)	0	100	100
1	D	180/176 (102%)	175 (97%)	5 (3%)	0	100	100
All	All	741/704 (105%)	717 (97%)	24 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	155/137 (113%)	153 (99%)	2 (1%)	65	39
1	B	153/137 (112%)	152 (99%)	1 (1%)	81	66
1	C	144/137 (105%)	143 (99%)	1 (1%)	81	66
1	D	144/137 (105%)	142 (99%)	2 (1%)	62	37
All	All	596/548 (109%)	590 (99%)	6 (1%)	75	52

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	160[A]	LEU
1	A	160[B]	LEU
1	B	80	GLU
1	C	122	SER
1	D	64	VAL
1	D	122	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	6	ASN
1	A	119	ASN
1	B	63	ASN
1	B	119	ASN
1	C	72	ASN
1	C	88	GLN
1	D	32	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](#)

Of 24 ligands modelled in this entry, 13 are monoatomic - leaving 11 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
3	GOL	A	203	-	5,5,5	0.21	0	5,5,5	0.27	0
3	GOL	D	203	-	5,5,5	0.17	0	5,5,5	0.45	0
3	GOL	B	203	-	5,5,5	0.28	0	5,5,5	0.72	0
2	MQP	C	201	1	60,60,60	1.25	9 (15%)	69,94,94	1.01	4 (5%)
3	GOL	A	202	-	5,5,5	0.11	0	5,5,5	0.35	0
2	MQP	B	202	1	60,60,60	1.00	3 (5%)	69,94,94	0.95	5 (7%)
3	GOL	D	202	-	5,5,5	0.11	0	5,5,5	0.35	0
3	GOL	A	204	-	5,5,5	0.11	0	5,5,5	0.30	0
3	GOL	B	201	-	5,5,5	0.13	0	5,5,5	0.27	0
2	MQP	D	201	1	60,60,60	1.21	7 (11%)	69,94,94	1.44	11 (15%)
2	MQP	A	201	1	60,60,60	1.24	8 (13%)	69,94,94	0.92	5 (7%)

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
3	GOL	A	203	-	-	0/4/4/4	-
3	GOL	D	203	-	-	4/4/4/4	-
3	GOL	B	203	-	-	2/4/4/4	-
2	MQP	C	201	1	-	0/16/72/72	0/4/12/12
3	GOL	A	202	-	-	3/4/4/4	-
2	MQP	B	202	1	-	0/16/72/72	0/4/12/12
3	GOL	D	202	-	-	2/4/4/4	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GOL	A	204	-	-	0/4/4/4	-
3	GOL	B	201	-	-	0/4/4/4	-
2	MQP	D	201	1	-	0/16/72/72	0/4/12/12
2	MQP	A	201	1	-	0/16/72/72	0/4/12/12

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	201	MQP	CAE-NAI	-3.41	1.34	1.40
2	A	201	MQP	CAK-CAJ	-3.39	1.37	1.44
2	D	201	MQP	CAL-CAM	-3.35	1.37	1.44
2	B	202	MQP	CAW-CAD	-3.23	1.37	1.47
2	D	201	MQP	CAP-CAO	-3.15	1.37	1.44
2	C	201	MQP	CAW-NAX	3.00	1.42	1.36
2	C	201	MQP	CAW-CAD	-2.99	1.38	1.47
2	C	201	MQP	CAF-CAE	-2.92	1.38	1.44
2	D	201	MQP	CAW-CAD	-2.91	1.38	1.47
2	C	201	MQP	CAK-CAJ	-2.90	1.38	1.44
2	A	201	MQP	CAT-CAC	-2.77	1.39	1.47
2	D	201	MQP	CAC-CAR	2.75	1.43	1.37
2	D	201	MQP	FE-NAN	2.73	2.06	1.95
2	A	201	MQP	CAR-NAS	-2.69	1.35	1.40
2	B	202	MQP	CAE-NAI	-2.54	1.35	1.40
2	C	201	MQP	CAG-CAH	-2.46	1.39	1.44
2	C	201	MQP	CAE-NAI	-2.42	1.36	1.40
2	A	201	MQP	CAW-CAD	-2.39	1.40	1.47
2	D	201	MQP	CAT-CAC	-2.37	1.40	1.47
2	A	201	MQP	FE-NAN	2.21	2.04	1.95
2	A	201	MQP	CAG-CAH	-2.15	1.39	1.44
2	C	201	MQP	FE-NAI	2.09	2.08	1.97
2	A	201	MQP	CAL-CAM	-2.06	1.40	1.44
2	C	201	MQP	CAT-CAC	-2.05	1.41	1.47
2	D	201	MQP	CAD-CAE	2.03	1.41	1.37
2	B	202	MQP	CAG-CAH	-2.01	1.40	1.44
2	C	201	MQP	CAR-NAS	-2.00	1.36	1.40

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	201	MQP	CAA-CAJ-NAN	-5.18	120.01	125.79
2	D	201	MQP	CAA-CAH-NAI	-4.00	120.17	125.46
2	D	201	MQP	CAC-CAR-NAS	-3.90	121.21	125.79

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	201	MQP	CAY-CAA-CAJ	-3.81	111.06	117.94
2	C	201	MQP	CBK-CAC-CAT	-3.43	113.24	117.56
2	B	202	MQP	CAA-CAJ-NAN	-3.29	122.12	125.79
2	D	201	MQP	CAJ-CAA-CAH	3.07	130.91	124.29
2	B	202	MQP	CBQ-CAD-CAW	-2.78	114.06	117.56
2	D	201	MQP	CAG-CAH-CAA	2.76	131.02	125.18
2	C	201	MQP	CAA-CAH-NAI	-2.64	121.98	125.46
2	D	201	MQP	CAQ-CAR-CAC	2.63	130.62	125.97
2	A	201	MQP	CAD-CAE-NAI	-2.55	122.80	125.79
2	D	201	MQP	CBE-CAB-CAO	-2.55	113.24	117.77
2	A	201	MQP	CAY-CAA-CAH	-2.45	113.42	117.77
2	C	201	MQP	CAC-CAR-NAS	-2.38	123.00	125.79
2	A	201	MQP	CAE-NAI-CAH	2.28	107.42	105.07
2	C	201	MQP	CAL-CAK-CAJ	2.25	110.18	107.53
2	A	201	MQP	CAR-NAS-CAO	2.20	107.35	105.07
2	D	201	MQP	CAM-CAB-CAO	2.18	129.00	124.29
2	D	201	MQP	CAK-CAJ-CAA	2.13	131.37	125.73
2	A	201	MQP	CBE-CAB-CAO	-2.11	114.03	117.77
2	B	202	MQP	CAG-CAH-NAI	-2.09	108.57	110.42
2	B	202	MQP	CAB-CAM-NAN	-2.02	123.53	125.79
2	D	201	MQP	CBQ-CAD-CAW	-2.02	115.02	117.56
2	B	202	MQP	CAJ-CAA-CAH	2.00	128.61	124.29

There are no chirality outliers.

All (11) torsion outliers are listed below:

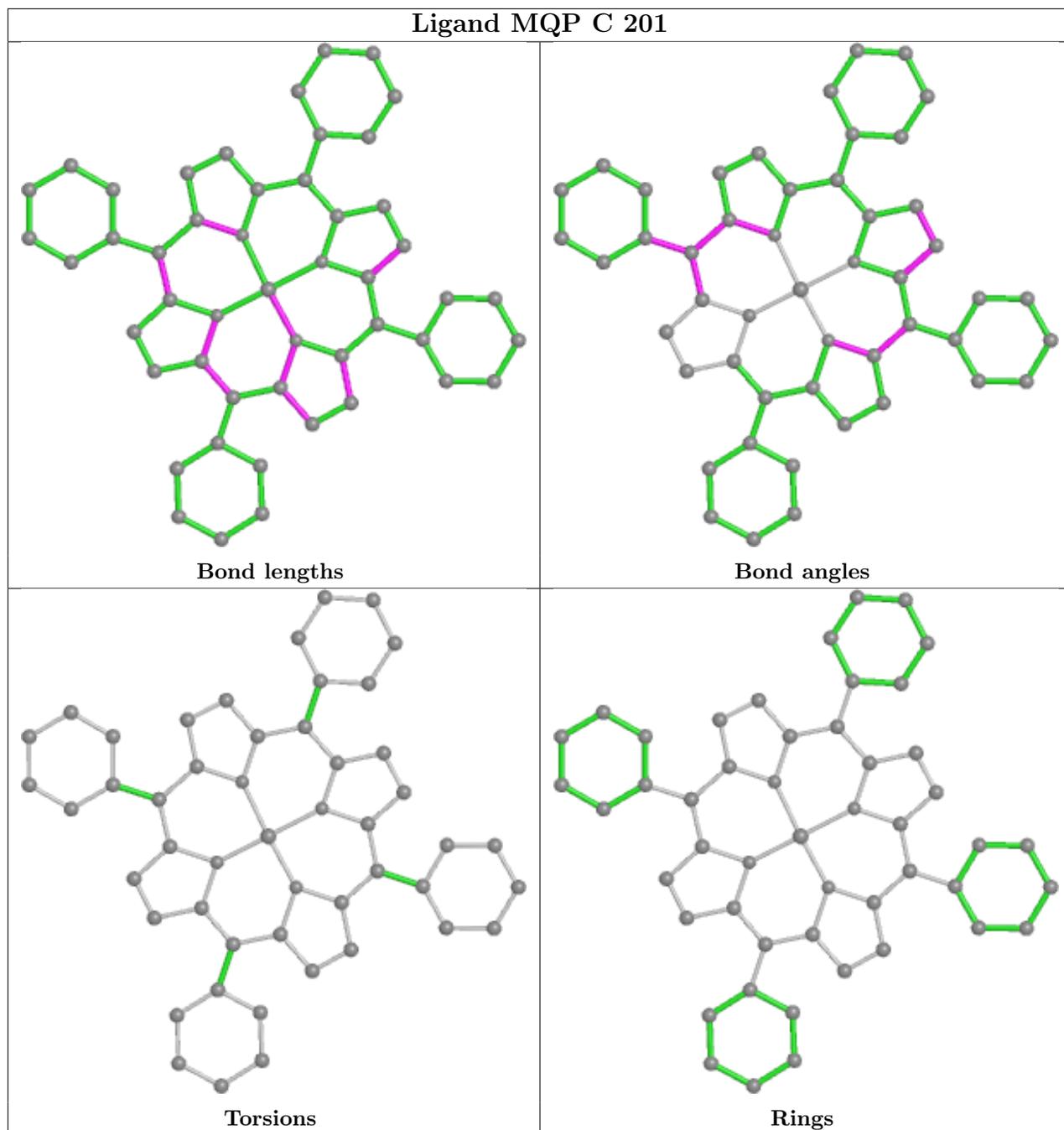
Mol	Chain	Res	Type	Atoms
3	A	202	GOL	C1-C2-C3-O3
3	B	203	GOL	C1-C2-C3-O3
3	D	202	GOL	C1-C2-C3-O3
3	D	203	GOL	C1-C2-C3-O3
3	A	202	GOL	O2-C2-C3-O3
3	D	203	GOL	O2-C2-C3-O3
3	D	203	GOL	O1-C1-C2-C3
3	D	202	GOL	O2-C2-C3-O3
3	B	203	GOL	O2-C2-C3-O3
3	D	203	GOL	O1-C1-C2-O2
3	A	202	GOL	O1-C1-C2-O2

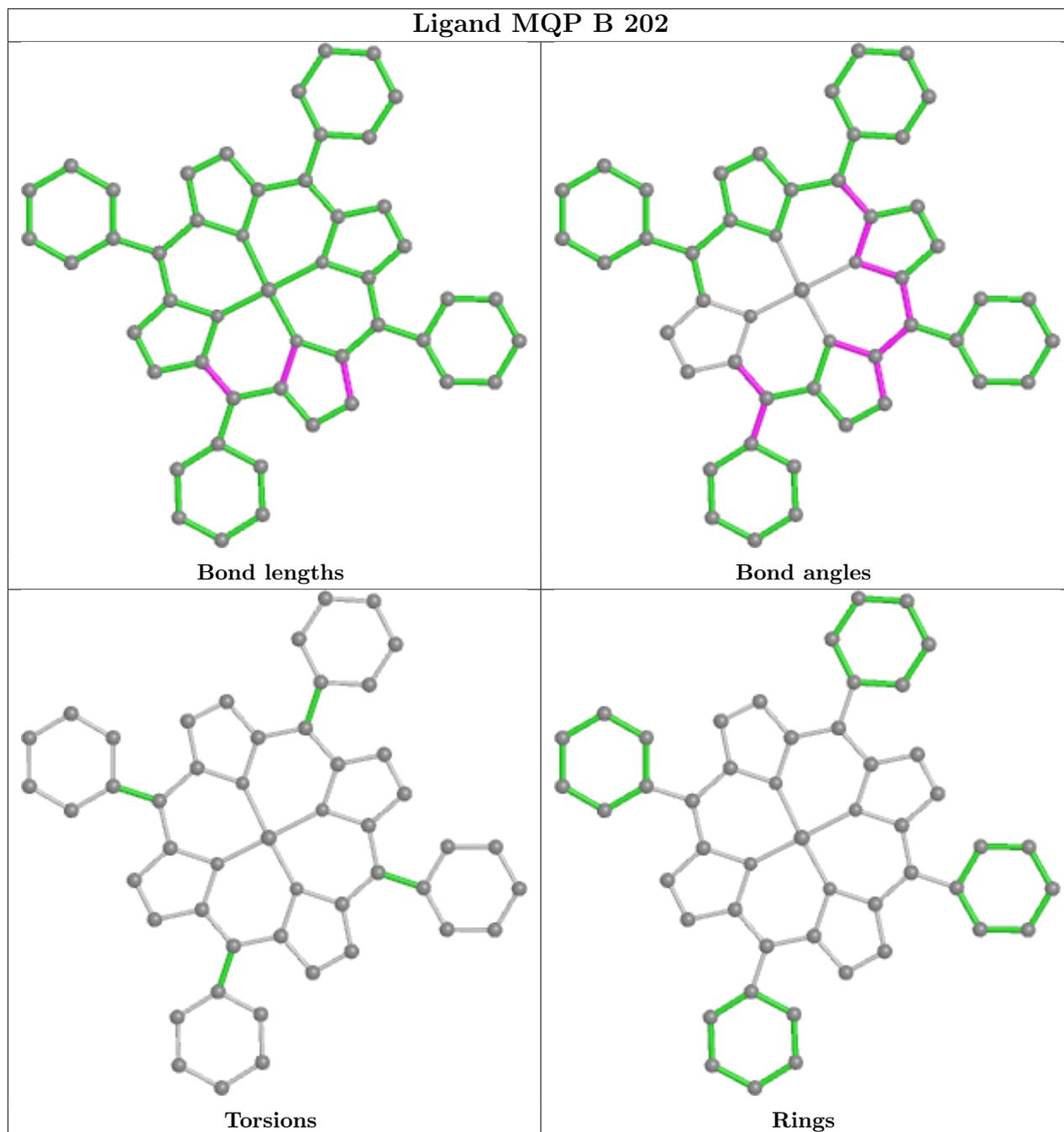
There are no ring outliers.

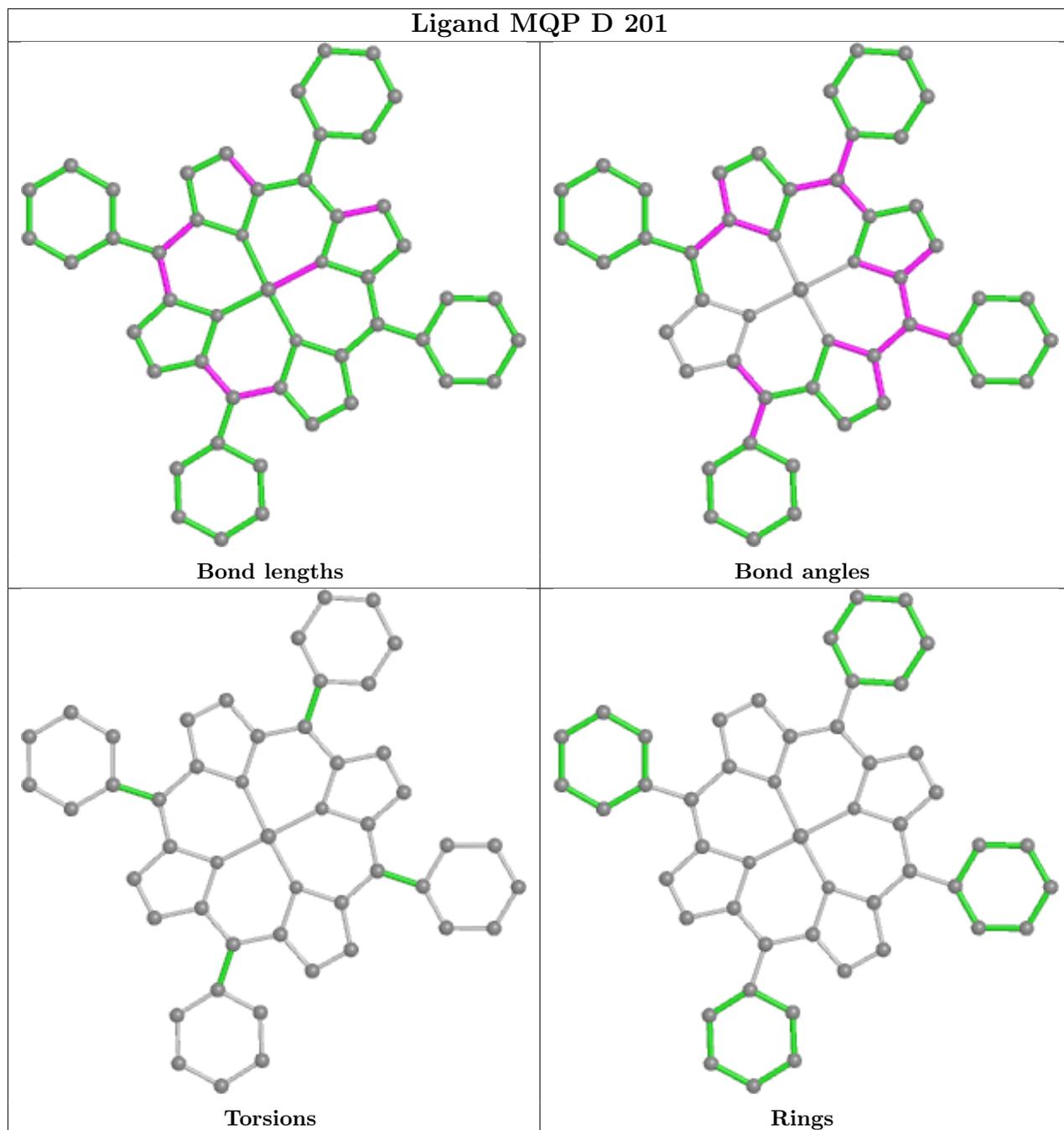
2 monomers are involved in 3 short contacts:

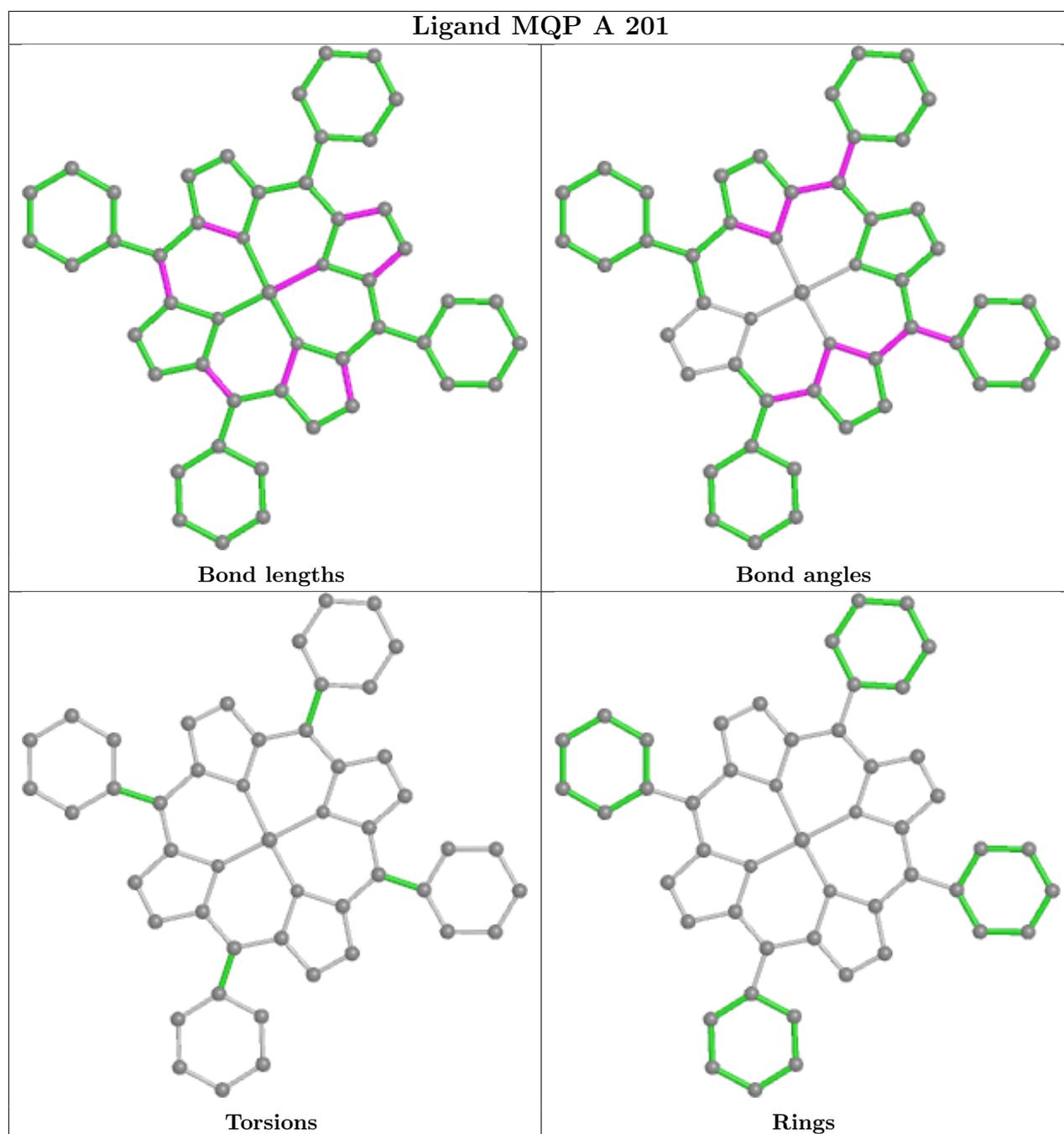
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	203	GOL	2	0
2	A	201	MQP	1	0

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, 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	176/176 (100%)	0.04	4 (2%) 61 66	4, 13, 24, 29	11 (6%)
1	B	176/176 (100%)	-0.30	0 100 100	3, 9, 18, 31	11 (6%)
1	C	173/176 (98%)	-0.10	2 (1%) 76 80	5, 12, 25, 46	5 (2%)
1	D	173/176 (98%)	-0.04	2 (1%) 76 80	4, 12, 26, 51	5 (2%)
All	All	698/704 (99%)	-0.10	8 (1%) 77 81	3, 11, 24, 51	32 (4%)

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	1	MET	4.8
1	C	1	MET	3.8
1	A	13	ALA	3.0
1	D	103	THR	2.7
1	A	142	GLY	2.6
1	C	9	SER	2.6
1	A	175[A]	VAL	2.3
1	A	160[A]	LEU	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](#)

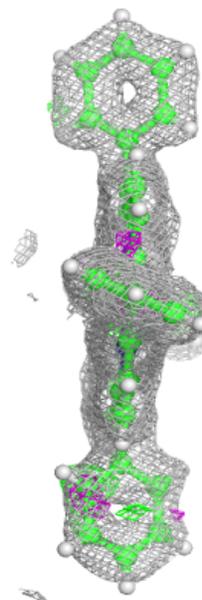
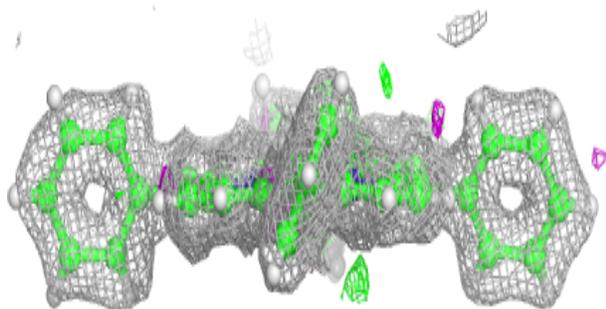
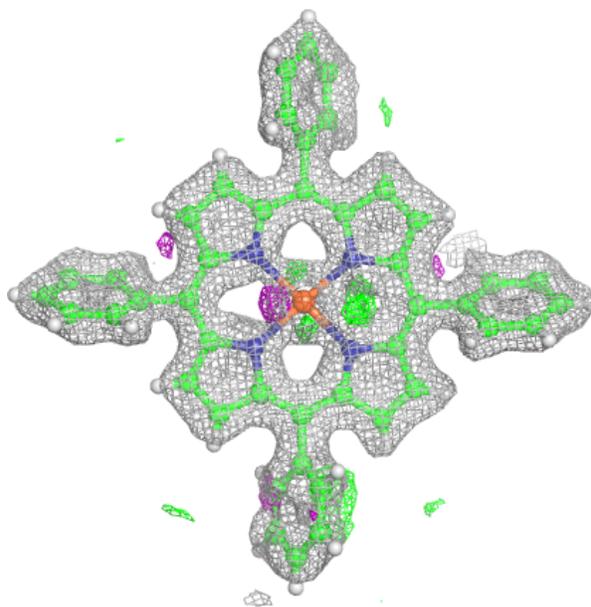
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	GOL	A	202	6/6	0.78	0.19	25,35,36,39	3
3	GOL	D	203	6/6	0.79	0.18	20,36,39,40	3
3	GOL	B	201	6/6	0.83	0.12	20,30,33,34	3
3	GOL	D	202	6/6	0.87	0.12	25,31,31,32	3
3	GOL	A	204	6/6	0.88	0.13	20,29,34,38	3
4	NA	A	207	1/1	0.90	0.13	36,36,36,36	0
3	GOL	A	203	6/6	0.91	0.11	18,19,20,21	3
3	GOL	B	203	6/6	0.92	0.10	19,23,24,24	3
4	NA	C	203	1/1	0.92	0.10	34,34,34,34	0
4	NA	D	206	1/1	0.92	0.10	36,36,36,36	0
4	NA	B	205	1/1	0.95	0.09	27,27,27,27	0
4	NA	C	202	1/1	0.95	0.07	15,15,15,15	0
4	NA	D	204	1/1	0.96	0.05	18,18,18,18	0
4	NA	B	204	1/1	0.97	0.05	13,13,13,13	0
4	NA	B	206	1/1	0.97	0.07	28,28,28,28	0
4	NA	A	205	1/1	0.98	0.03	15,15,15,15	0
4	NA	B	207	1/1	0.98	0.03	14,14,14,14	0
2	MQP	C	201	49/49	0.98	0.06	6,7,14,15	0
4	NA	A	208	1/1	0.98	0.06	8,8,8,8	0
2	MQP	D	201	49/49	0.98	0.06	6,7,17,19	0
2	MQP	B	202	49/49	0.98	0.05	5,6,11,13	0
2	MQP	A	201	49/49	0.99	0.05	6,7,14,15	0
4	NA	D	205	1/1	0.99	0.03	10,10,10,10	0
4	NA	A	206	1/1	0.99	0.05	16,16,16,16	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.

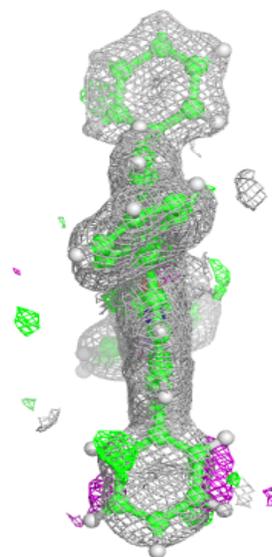
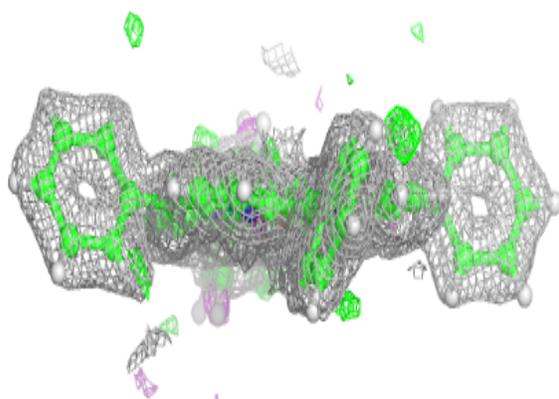
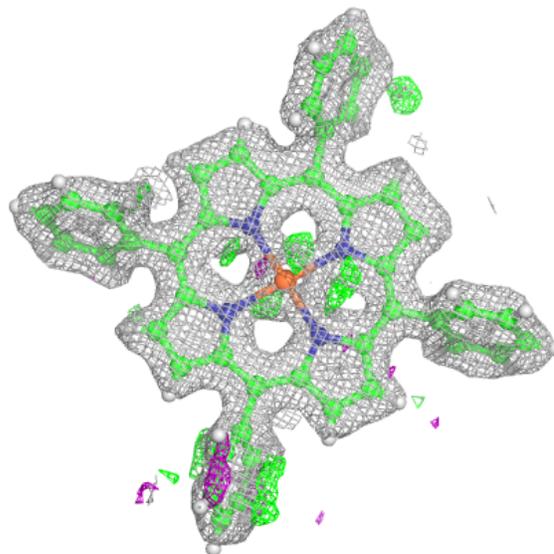
**Electron density around MQP C 201:**

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



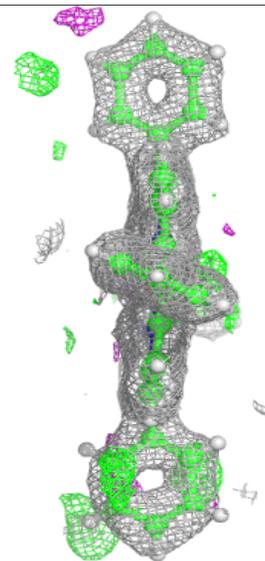
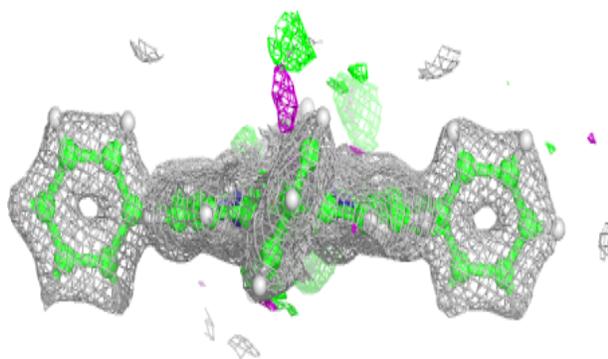
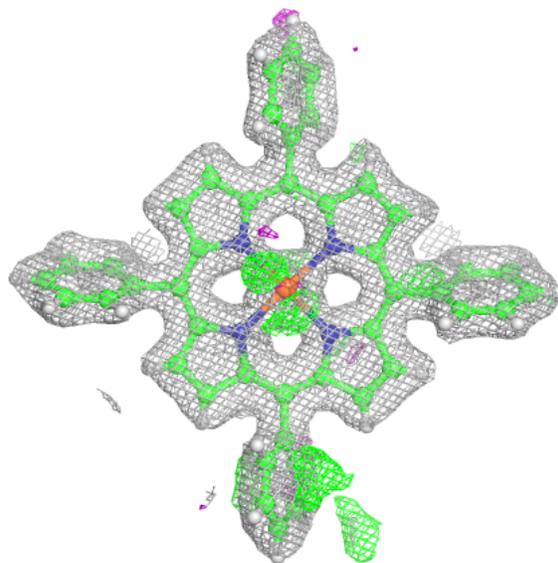
**Electron density around MQP D 201:**

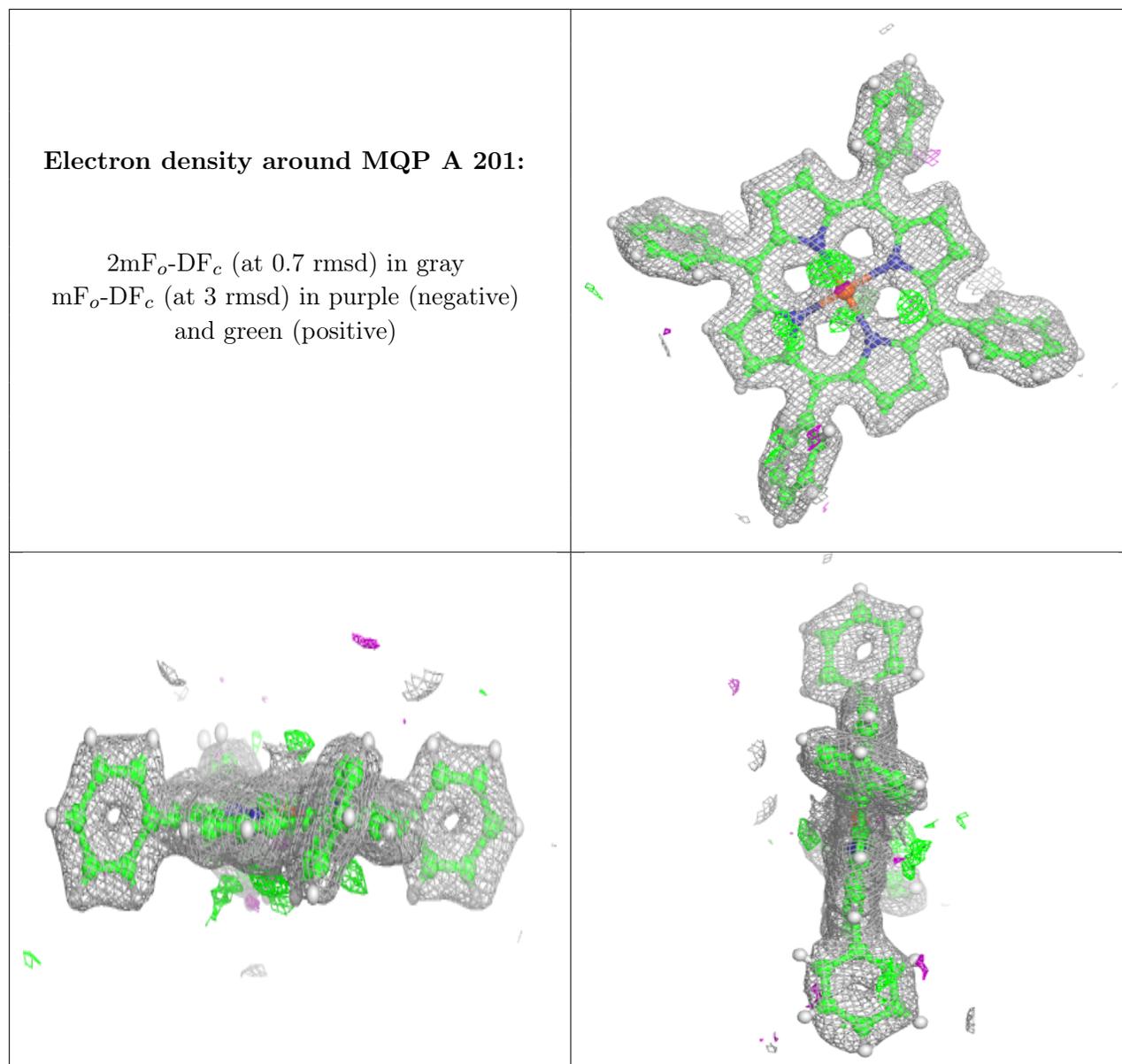
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around MQP B 202:**

$2mF_o-DF_c$  (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.