wwPDB X-ray Structure Validation Summary Report (i)

Jun 24, 2024 – 04:08 PM EDT

PDB ID	:	7BZ4
Title	:	The mutant variant of PNGM-1. H279 was substituted for alanine to study metal coordination.
Authors	:	Park, Y.S.; Kang, L.W.; Lee, J.H.
Deposited on	:	2020-04-26
Resolution	:	2.16 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

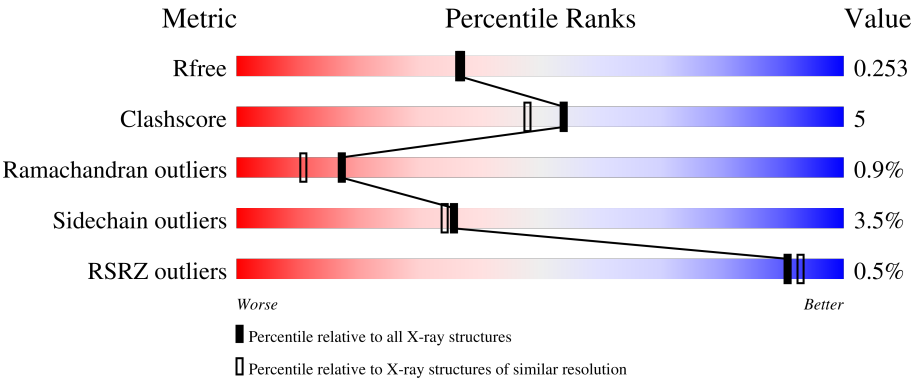
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.20.1
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 2.16 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}	130704	1479 (2.16-2.16)
Clashscore	141614	1585 (2.16-2.16)
Ramachandran outliers	138981	1560 (2.16-2.16)
Sidechain outliers	138945	1559 (2.16-2.16)
RSRZ outliers	127900	1456 (2.16-2.16)

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	372	87% 9%
1	B	372	% 85% 10%
1	C	372	80% 15%
1	D	372	% 85% 12%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 12042 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 Metallo-beta-lactamase PNGM-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	362	Total	C	N	O	S	0	0	0
			2851	1805	490	536	20			
1	B	360	Total	C	N	O	S	0	0	0
			2823	1789	481	533	20			
1	C	360	Total	C	N	O	S	0	0	0
			2823	1789	481	533	20			
1	D	362	Total	C	N	O	S	0	0	0
			2847	1804	487	536	20			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	279	ALA	HIS	engineered mutation	UNP A0A2U8UYM6
B	279	ALA	HIS	engineered mutation	UNP A0A2U8UYM6
C	279	ALA	HIS	engineered mutation	UNP A0A2U8UYM6
D	279	ALA	HIS	engineered mutation	UNP A0A2U8UYM6

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

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

- Molecule 3 is water.

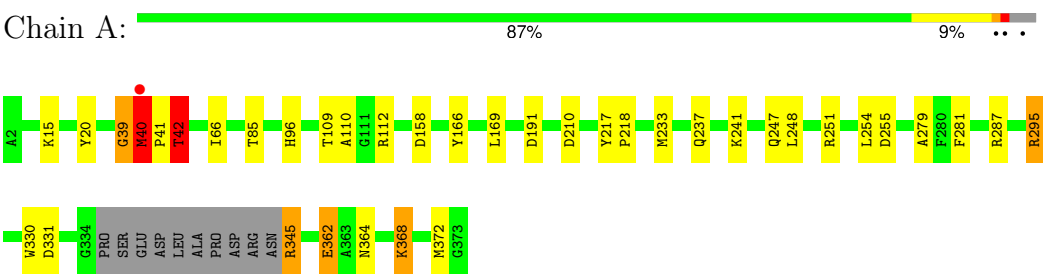
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	218	Total O 218 218	0	0
3	B	175	Total O 175 175	0	0
3	C	137	Total O 137 137	0	0
3	D	164	Total O 164 164	0	0

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.

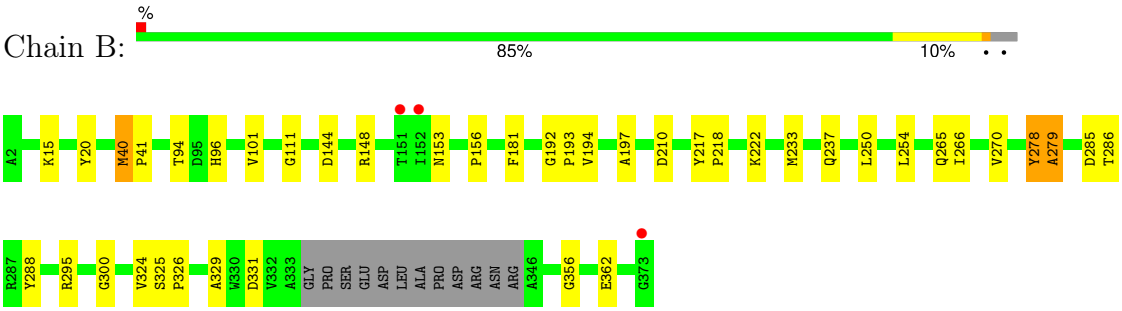
• Molecule 1: Metallo-beta-lactamase PNGM-1

Chain A:



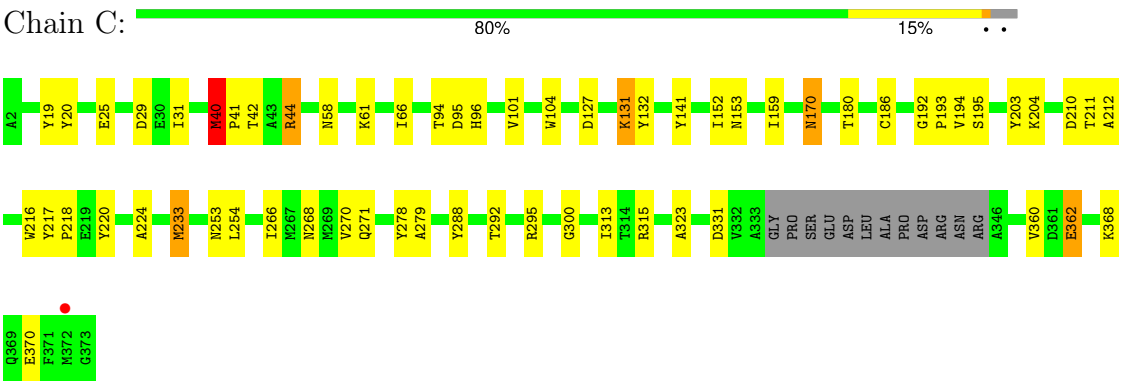
• Molecule 1: Metallo-beta-lactamase PNGM-1

Chain B:



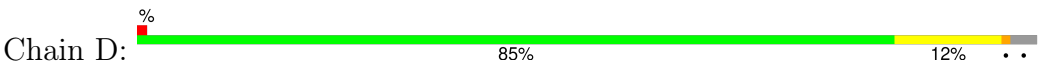
• Molecule 1: Metallo-beta-lactamase PNGM-1

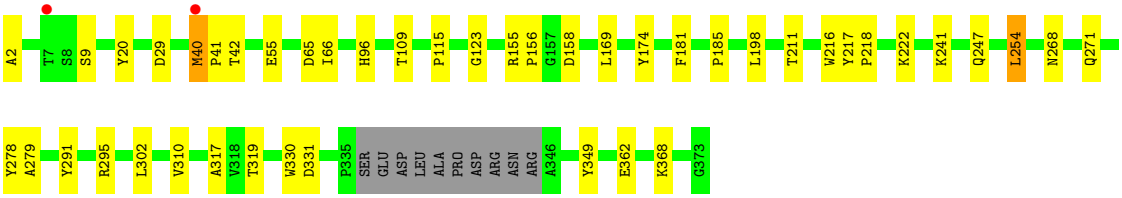
Chain C:



• Molecule 1: Metallo-beta-lactamase PNGM-1

Chain D:




A2
T7
S8
S9
Y20
D29
M40
P41
T42
E55
D65
I66
H96
T109
P115
G123
R155
P156
G157
D158
L169
Y174
F181
P185
L198
T211
W216
Y217
P218
K222
K241
Q247
L254
N268
Q271
Y278
A279
Y291
R295
L302
V310
A317
V318
T319
W330
D331
P335
SER
GLU
ASP
LEU
ALA
PRO
ASP
ARG
ASN
ARG
A346
Y349
E362
K368
G373

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	121.86Å 82.96Å 164.04Å 90.00° 110.94° 90.00°	Depositor
Resolution (Å)	48.08 – 2.16 48.03 – 2.16	Depositor EDS
% Data completeness (in resolution range)	96.5 (48.08-2.16) 96.5 (48.03-2.16)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	0.17	Depositor
$< I/\sigma(I) >$ [1]	2.35 (at 2.16Å)	Xtriage
Refinement program	REFMAC 5.8.0257	Depositor
R, R_{free}	0.193 , 0.249 0.199 , 0.253	Depositor DCC
R_{free} test set	3906 reflections (4.91%)	wwPDB-VP
Wilson B-factor (Å^2)	15.6	Xtriage
Anisotropy	0.111	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 33.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.015 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	12042	wwPDB-VP
Average B, all atoms (Å^2)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.41% 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: ZN

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	0.76	0/2933	0.95	4/3995 (0.1%)
1	B	0.75	0/2905	0.90	0/3960
1	C	0.76	0/2905	0.93	2/3960 (0.1%)
1	D	0.78	1/2930 (0.0%)	0.90	0/3993
All	All	0.76	1/11673 (0.0%)	0.92	6/15908 (0.0%)

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	C	0	1
1	D	0	2
All	All	0	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	55	GLU	CD-OE1	5.43	1.31	1.25

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	295	ARG	NE-CZ-NH1	6.70	123.65	120.30
1	C	44	ARG	CB-CA-C	-6.24	97.92	110.40
1	C	44	ARG	NE-CZ-NH1	5.45	123.03	120.30
1	A	39	GLY	C-N-CA	5.41	135.23	121.70
1	A	345	ARG	NE-CZ-NH2	-5.21	117.70	120.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	40	MET	Peptide
1	D	211	THR	Peptide
1	D	317	ALA	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	2851	0	2683	32	0
1	B	2823	0	2641	35	0
1	C	2823	0	2641	41	0
1	D	2847	0	2677	28	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	218	0	0	6	0
3	B	175	0	0	9	0
3	C	137	0	0	11	0
3	D	164	0	0	6	0
All	All	12042	0	10642	117	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 5.

The worst 5 of 117 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:123:GLY:O	3:D:501:HOH:O	1.68	1.09
1:B:194:VAL:HG13	3:B:502:HOH:O	1.52	1.08
1:C:42:THR:HG22	3:C:545:HOH:O	1.50	1.07
1:D:40:MET:HB3	1:D:41:PRO:CD	1.93	0.98
1:D:40:MET:HB3	1:D:41:PRO:HD3	1.44	0.98

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	358/372 (96%)	343 (96%)	12 (3%)	3 (1%)	19 12
1	B	356/372 (96%)	334 (94%)	20 (6%)	2 (1%)	25 18
1	C	356/372 (96%)	326 (92%)	25 (7%)	5 (1%)	11 5
1	D	358/372 (96%)	338 (94%)	17 (5%)	3 (1%)	19 12
All	All	1428/1488 (96%)	1341 (94%)	74 (5%)	13 (1%)	17 11

5 of 13 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	40	MET
1	B	40	MET
1	C	40	MET
1	D	40	MET
1	A	279	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	292/301 (97%)	279 (96%)	13 (4%)	27 24
1	B	288/301 (96%)	282 (98%)	6 (2%)	53 57
1	C	288/301 (96%)	278 (96%)	10 (4%)	36 34

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	D	292/301 (97%)	280 (96%)	12 (4%)	30 29
All	All	1160/1204 (96%)	1119 (96%)	41 (4%)	36 34

5 of 41 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	368	LYS
1	D	278	TYR
1	D	29	ASP
1	D	222	LYS
1	D	319	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	369	GLN
1	D	175	GLN
1	D	369	GLN
1	D	243	ASN
1	B	75	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{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	362/372 (97%)	-0.31	1 (0%)	94	95	5, 13, 34, 57	0
1	B	360/372 (96%)	-0.23	3 (0%)	86	89	5, 16, 42, 57	0
1	C	360/372 (96%)	0.15	1 (0%)	94	95	13, 25, 46, 66	0
1	D	362/372 (97%)	-0.14	2 (0%)	89	91	7, 17, 37, 61	0
All	All	1444/1488 (97%)	-0.13	7 (0%)	91	93	5, 18, 41, 66	0

The worst 5 of 7 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	40	MET	3.7
1	C	372	MET	3.4
1	D	7	THR	3.3
1	D	40	MET	3.0
1	B	152	ILE	2.5

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

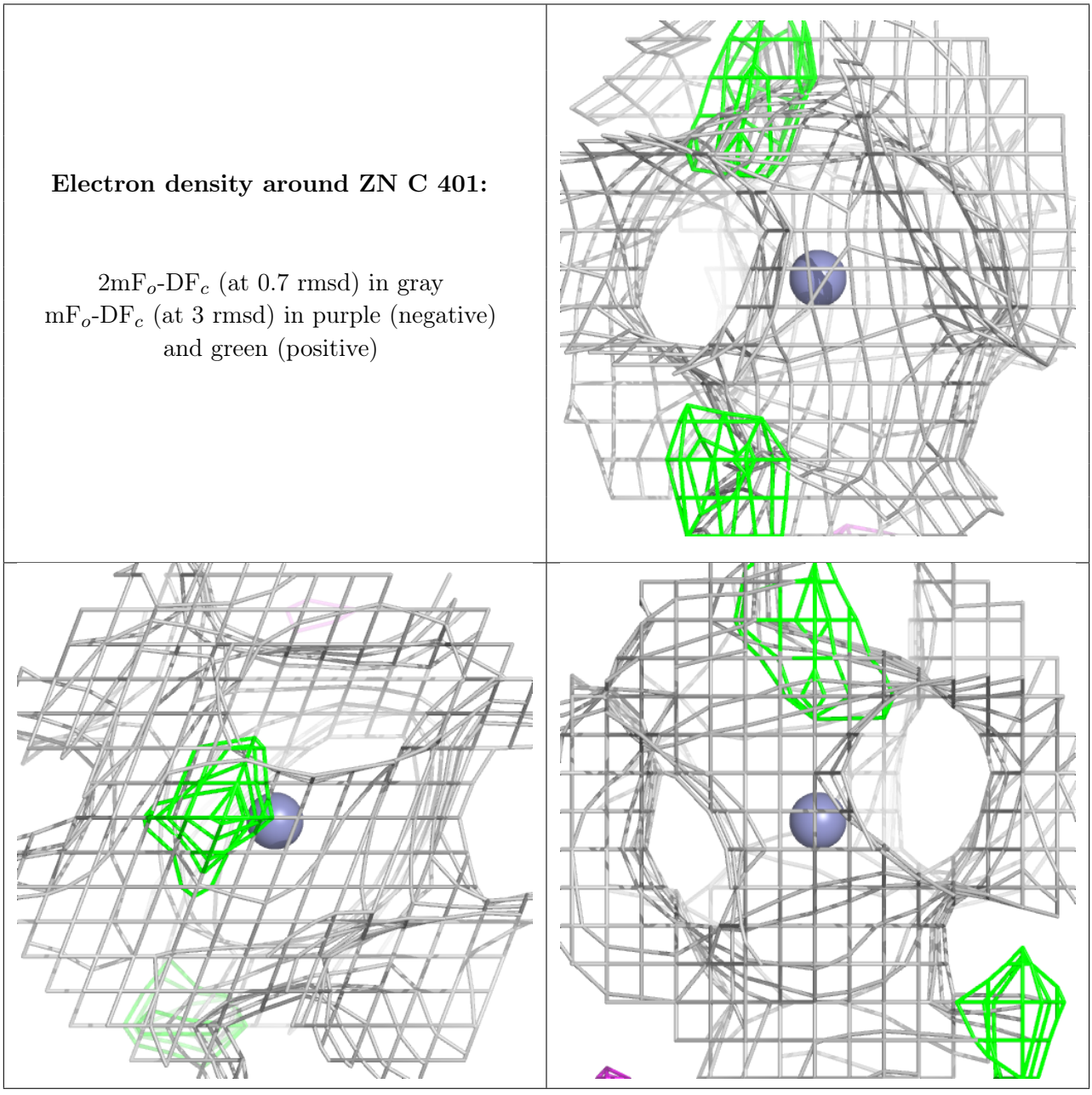
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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
2	ZN	C	401	1/1	0.99	0.06	20,20,20,20	0
2	ZN	B	401	1/1	1.00	0.06	21,21,21,21	0
2	ZN	A	401	1/1	1.00	0.06	11,11,11,11	0
2	ZN	D	401	1/1	1.00	0.07	15,15,15,15	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.

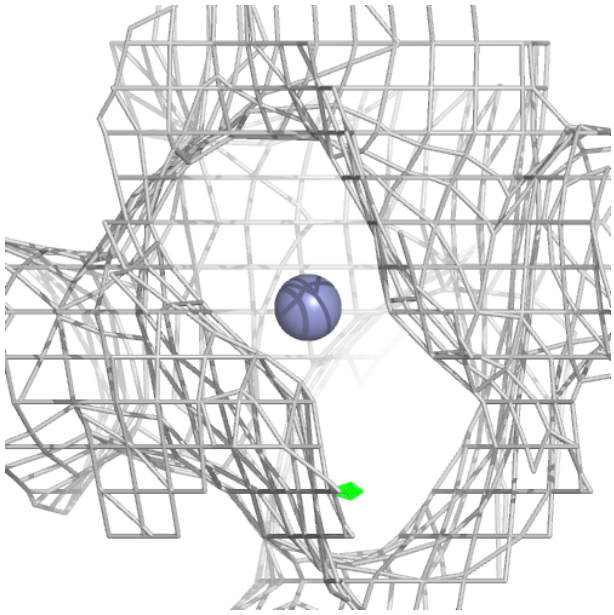
Electron density around ZN C 401:

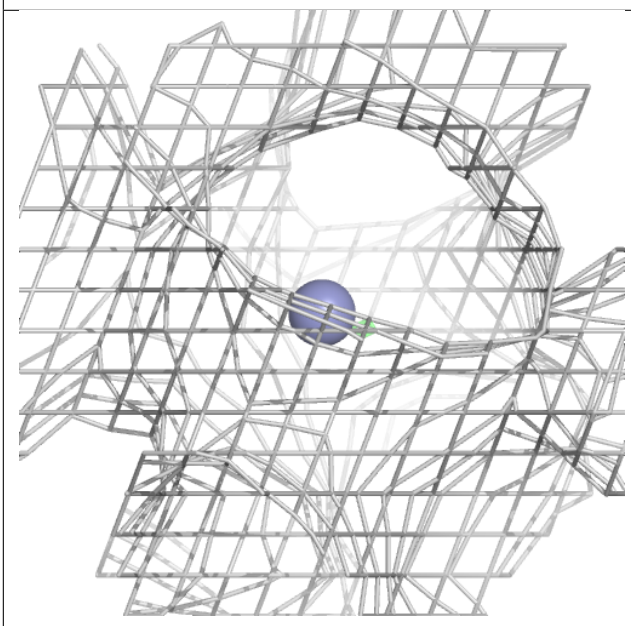
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

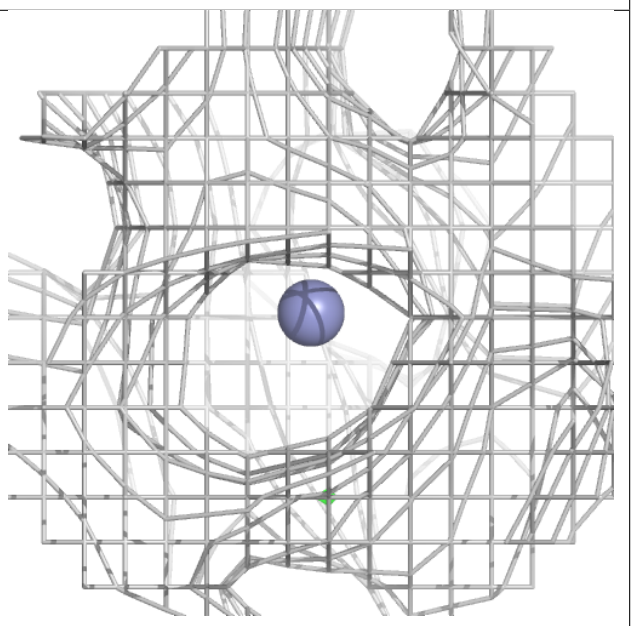


Electron density around ZN B 401:

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

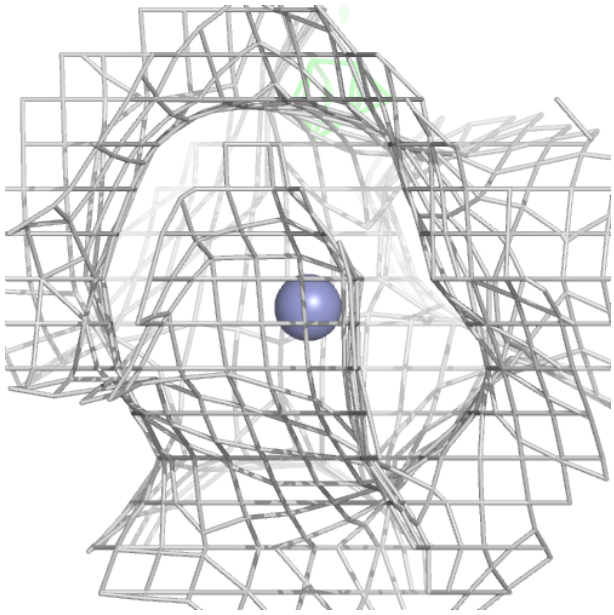


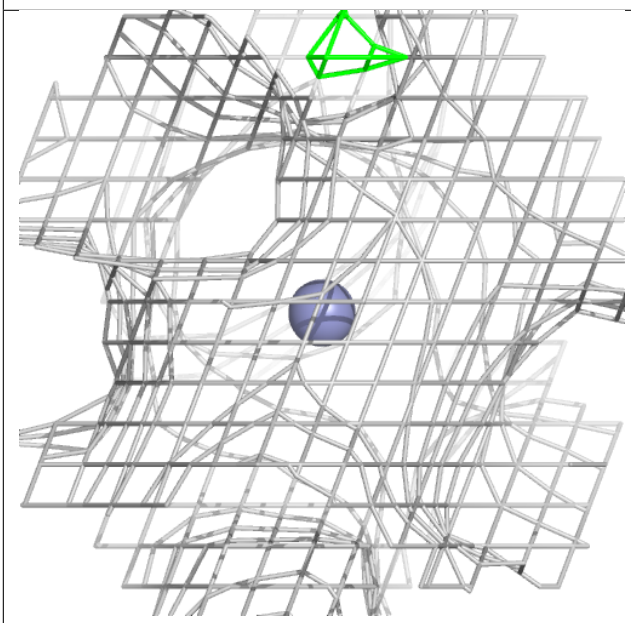


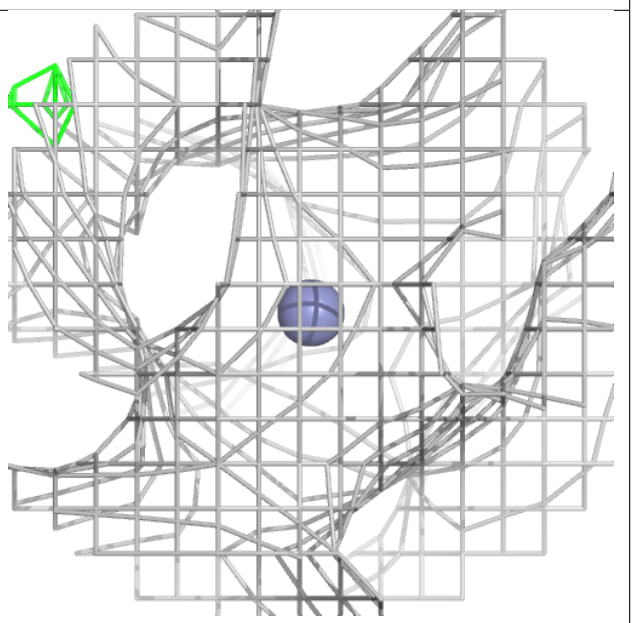


Electron density around ZN A 401:

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

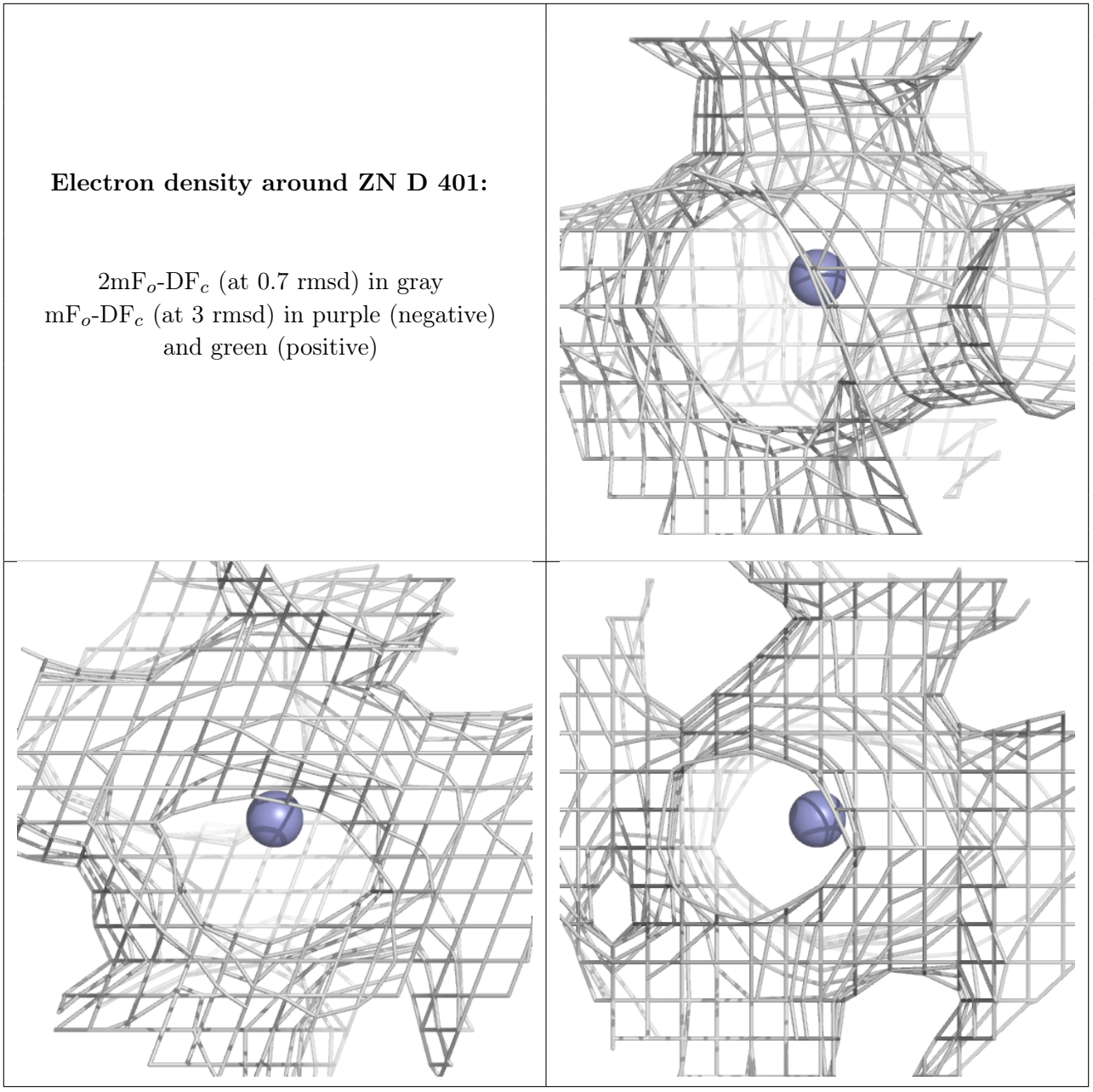






Electron density around ZN D 401:

$2mF_o$-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.