



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 15, 2017 – 12:48 am GMT

PDB ID : 3C75  
Title : Paracoccus versutus methylamine dehydrogenase in complex with amicyanin  
Authors : Cavalieri, C.; Biermann, N.; Vlasie, M.D.; Einsle, O.; Merli, A.; Ferrari, D.; Rossi, G.L.; Ubbink, M.  
Deposited on : 2008-02-06  
Resolution : 2.50 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467  
Mogul : 1.7.2 (RC1), CSD as538be (2017)  
Xtriage (Phenix) : 1.9-1692  
EDS : trunk28620  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : recalc28949

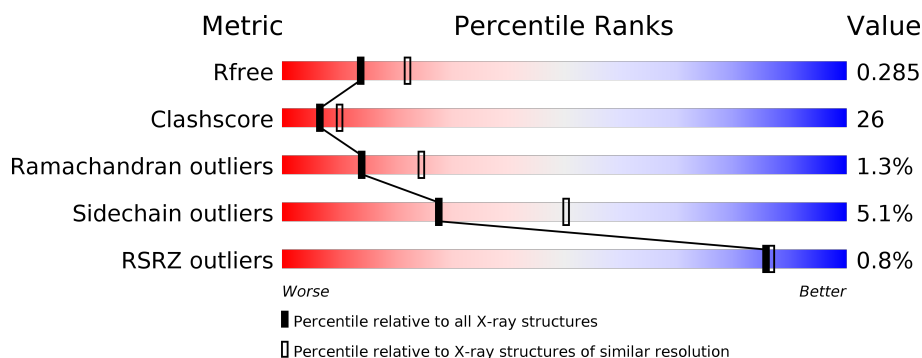
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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))
$R_{free}$	100719	3846 (2.50-2.50)
Clashscore	112137	4554 (2.50-2.50)
Ramachandran outliers	110173	4463 (2.50-2.50)
Sidechain outliers	110143	4465 (2.50-2.50)
RSRZ outliers	101464	3876 (2.50-2.50)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	H	426	<div> <div>53%</div> <div>32%</div> <div>•</div> <div>12%</div> </div>
1	J	426	<div> <div>52%</div> <div>33%</div> <div>•</div> <div>12%</div> </div>
2	L	188	<div> <div>%</div> <div>38%</div> <div>26%</div> <div>• •</div> <div>34%</div> </div>
2	M	188	<div> <div>%</div> <div>39%</div> <div>24%</div> <div>• •</div> <div>34%</div> </div>
3	A	132	<div> <div>4%</div> <div>50%</div> <div>27%</div> <div>•</div> <div>20%</div> </div>
3	B	132	<div> <div>2%</div> <div>48%</div> <div>30%</div> <div>•</div> <div>20%</div> </div>

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 9803 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 Methylamine dehydrogenase heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	H	375	Total	C	N	O	S	0	0	0
			2925	1848	502	568	7			
1	J	375	Total	C	N	O	S	0	0	0
			2925	1848	502	568	7			

- Molecule 2 is a protein called Methylamine dehydrogenase light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	125	Total	C	N	O	S	0	0	0
			958	591	162	192	13			
2	M	125	Total	C	N	O	S	0	0	0
			958	591	162	192	13			

- Molecule 3 is a protein called Amicyanin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	A	106	Total	C	N	O	S	0	0	0
			821	527	131	157	6			
3	B	106	Total	C	N	O	S	0	0	0
			821	527	131	157	6			

- Molecule 4 is COPPER (II) ION (three-letter code: CU) (formula: Cu).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Cu	0	0
			1	1		
4	A	1	Total	Cu	0	0
			1	1		

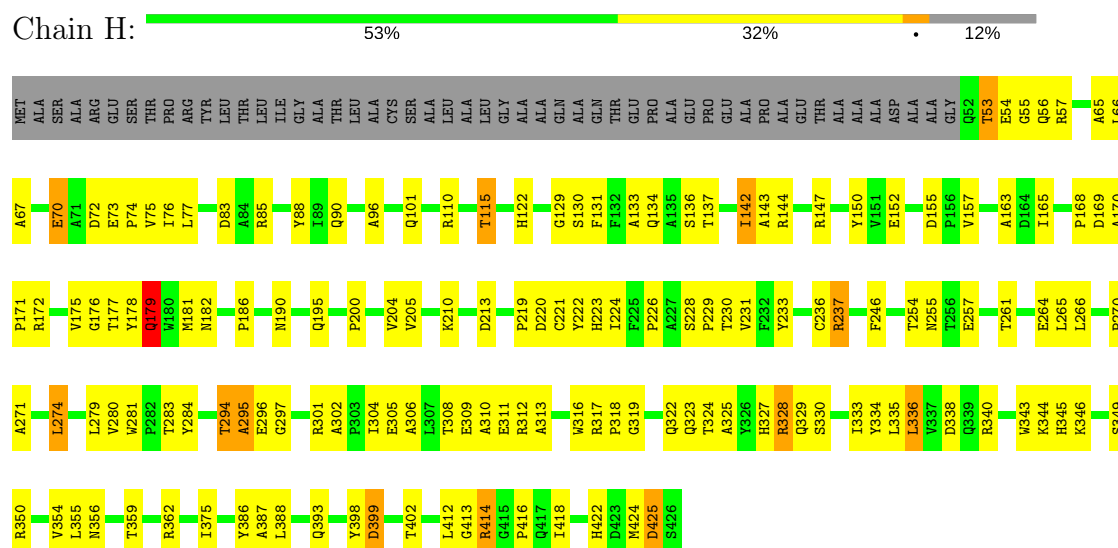
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	24	Total 24	O 24	0	0
5	B	39	Total 39	O 39	0	0
5	H	133	Total 133	O 133	0	0
5	J	119	Total 119	O 119	0	0
5	L	46	Total 46	O 46	0	0
5	M	32	Total 32	O 32	0	0

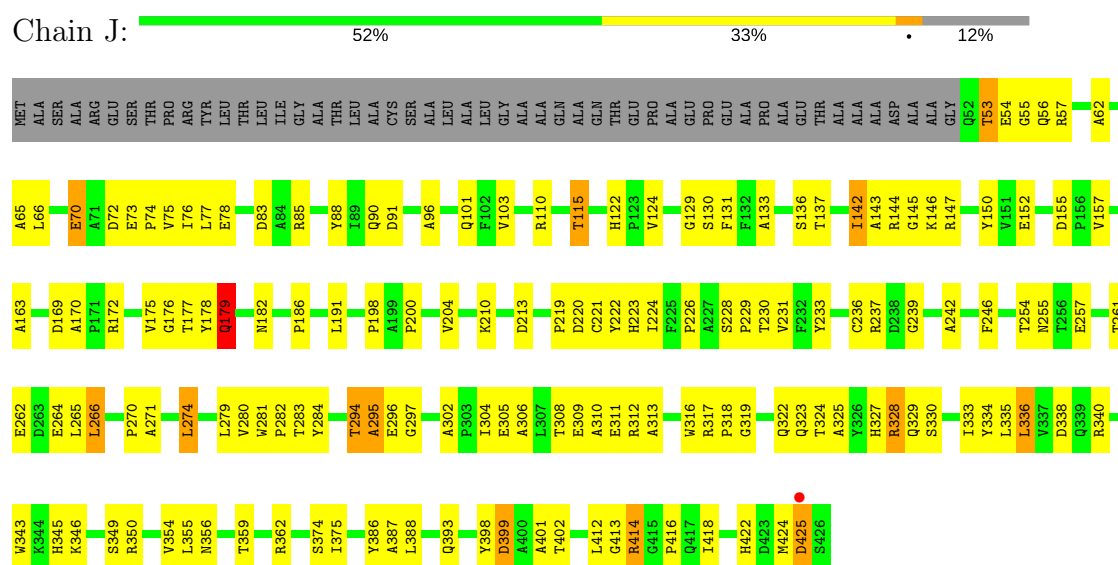
### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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: Methylamine dehydrogenase heavy chain



- Molecule 1: Methylamine dehydrogenase heavy chain



- Molecule 2: Methylamine dehydrogenase light chain



MET LEU GLY ASN PHE ARG ASP ASP MET VAL LYS LEU SER ARG VAL ALA GLY ARG THR SER ARG ARG GLY ALA ILE GLY LEU GLY THR VAL LEU ALA T54 A55 S56 W57 D66 G67 Q68 S69 L71 ASP ARG ARG GLY ARG VAL SER ARG ALA ASN ALA GLY PRO

ALA GLU GLY V7 A11 K12 W13 Q14 P15 VAL D17 N18 D19 I20 Q21 A22 Y25 W26 R27 H28 C29 S30 I31 D32 C36 D37 G41 N45 C46 P47 T54 A55 S56 W57 D66 G67 Q68 S69 L71 ASP ARG ARG GLY ARG VAL SER ARG ALA ASN ALA GLY PRO

G93 V97 V98 R99 P100 E101 N104 D105 I106 I107 W108 E113 H120 P125 I126 V127 G128 K129 A130 S131

• Molecule 2: Methylamine dehydrogenase light chain



MET LEU GLY ASN PHE ARG ASP ASP MET VAL LYS LEU SER ARG VAL ALA GLY ARG THR SER ARG ARG GLY ALA ILE GLY LEU GLY THR VAL LEU ALA T54 A55 S56 W57 D66 G67 Q68 S69 L71 ASP ARG ARG GLY ARG VAL SER ARG ALA ASN ALA GLY PRO

ALA GLU GLY V7 K12 W13 Q14 P15 VAL D17 N18 A22 Y25 W26 R27 H28 C29 S30 I31 D32 C36 G41 S42 P47 L52 A53 T54 A55 S56 W57 D66 G67 Q68 S69 L71 ASP ARG ARG GLY ARG VAL SER ARG ALA ASN ALA GLY PRO

Y98 R99 E101 A103 N104 D105 I106 W108 E113 H120 P125 I126 V127 G128 K129 A130 S131

• Molecule 3: Amicyanin



MET ILE SER ALA THR LEU ARG ARG PRO ALA ILE ALA ILE ALA LEU PHE ALA ILE GLY THR ALA TRP ALA Q1 D2 R3 I4 T7 S8 E9 K10 P11 V12 A15 P18 A19 D20 A21 E27 K28 M29 K30 V31 L32 T33 P34 E35 V36 T37 I38 E42

W46 V51 V63 D66 M72 M73 T74 Q77 A78 T82 T94 P95 H96 F97 F98 R99 G101 K102 V103 I104 V105 E106

• Molecule 3: Amicyanin



MET ILE SER ALA THR LEU ARG ARG PRO ALA ILE ALA ILE ALA LEU PHE ALA ILE GLY THR ALA TRP ALA Q1 D2 R3 I4 T7 S8 E9 K10 P11 V12 A15 P18 A19 D20 A21 E27 K28 M29 K30 V31 L32 T33 P34 E35 V36 T37 I38 E42 W46 V51

F58 V63 D66 M72 M73 T74 Q77 A78 T82 F83 Y91 F92 C93 T94 P95 H96 F97 F98 R99 G101 K102 V103 I104 V105 E106

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	55.57Å 131.04Å 171.69Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.15 – 2.50 30.16 – 2.45	Depositor EDS
% Data completeness (in resolution range)	82.4 (30.15-2.50) 80.3 (30.16-2.45)	Depositor EDS
$R_{merge}$	0.14	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.20 (at 2.45Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.235 , 0.283 0.236 , 0.285	Depositor DCC
$R_{free}$ test set	1130 reflections (3.09%)	DCC
Wilson B-factor (Å <sup>2</sup> )	33.9	Xtriage
Anisotropy	0.825	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 49.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	9803	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 46.68 % 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 1.1051e-04. 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

### 5.1 Standard geometry

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

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	H	0.59	0/2997	0.79	1/4085 (0.0%)
1	J	0.57	0/2997	0.79	0/4085
2	L	0.65	0/966	0.82	0/1317
2	M	0.64	0/966	0.83	0/1317
3	A	0.60	0/840	0.74	0/1138
3	B	0.61	0/840	0.74	0/1138
All	All	0.60	0/9606	0.79	1/13080 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	H	237	ARG	NE-CZ-NH2	-5.13	117.73	120.30

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts

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	H	2925	0	2796	158	0
1	J	2925	0	2796	162	0
2	L	958	0	858	71	0
2	M	958	0	858	67	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	821	0	810	38	1
3	B	821	0	810	36	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	24	0	0	3	1
5	B	39	0	0	4	2
5	H	133	0	0	13	0
5	J	119	0	0	14	0
5	L	46	0	0	1	0
5	M	32	0	0	5	0
All	All	9803	0	8928	477	2

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 26.

The worst 5 of 477 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:J:336:LEU:HD22	1:J:349:SER:HB2	1.34	1.08
1:H:336:LEU:HD22	1:H:349:SER:HB2	1.37	1.04
3:B:2:ASP:HB2	5:B:526:HOH:O	1.57	1.03
2:M:57:TRQ:HB2	2:M:108:TRP:NE1	1.83	0.94
2:M:57:TRQ:HB2	2:M:108:TRP:HE1	1.33	0.93

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:A:125:HOH:O	5:B:538:HOH:O[2_455]	1.83	0.37
3:A:35:GLU:N	5:B:538:HOH:O[2_455]	2.05	0.15

## 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	H	373/426 (88%)	334 (90%)	34 (9%)	5 (1%)	14	25
1	J	373/426 (88%)	338 (91%)	30 (8%)	5 (1%)	14	25
2	L	122/188 (65%)	109 (89%)	12 (10%)	1 (1%)	22	39
2	M	122/188 (65%)	109 (89%)	11 (9%)	2 (2%)	11	19
3	A	104/132 (79%)	98 (94%)	4 (4%)	2 (2%)	9	15
3	B	104/132 (79%)	98 (94%)	5 (5%)	1 (1%)	18	32
All	All	1198/1492 (80%)	1086 (91%)	96 (8%)	16 (1%)	14	25

5 of 16 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	A	19	ALA
3	B	19	ALA
1	H	70	GLU
1	H	142	ILE
1	H	295	ALA

### 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	H	303/335 (90%)	290 (96%)	13 (4%)	33	58
1	J	303/335 (90%)	290 (96%)	13 (4%)	33	58
2	L	104/149 (70%)	98 (94%)	6 (6%)	23	43
2	M	104/149 (70%)	98 (94%)	6 (6%)	23	43
3	A	87/102 (85%)	81 (93%)	6 (7%)	18	34
3	B	87/102 (85%)	81 (93%)	6 (7%)	18	34
All	All	988/1172 (84%)	938 (95%)	50 (5%)	28	50

5 of 50 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	A	51	VAL
1	J	66	LEU
3	B	37	THR
3	A	66	ASP
1	J	53	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 19 such sidechains are listed below:

Mol	Chain	Res	Type
3	A	1	GLN
1	J	323	GLN
2	M	34	ASN
2	L	104	ASN
2	M	68	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues 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	$\# Z  > 2$
2	TRQ	L	57	2	16,17,18	3.97	5 (31%)	15,24,26	1.38	3 (20%)
2	TRQ	M	57	2	16,17,18	3.79	5 (31%)	15,24,26	1.33	2 (13%)

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
2	TRQ	L	57	2	-	0/3/19/21	0/2/2/2
2	TRQ	M	57	2	-	0/3/19/21	0/2/2/2

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	L	57	TRQ	CH2-CZ2	-11.84	1.39	1.53
2	M	57	TRQ	CH2-CZ2	-10.83	1.40	1.53
2	L	57	TRQ	CE2-CZ2	-8.41	1.39	1.49
2	M	57	TRQ	CE2-CZ2	-8.15	1.40	1.49
2	L	57	TRQ	CA-C	2.68	1.53	1.50

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	M	57	TRQ	O7-CZ2-CE2	-2.46	119.22	122.03
2	L	57	TRQ	O7-CZ2-CE2	-2.36	119.35	122.03
2	L	57	TRQ	CD2-CE3-CZ3	-2.03	118.54	121.09
2	L	57	TRQ	O7-CZ2-CH2	2.06	121.09	119.03
2	M	57	TRQ	O7-CZ2-CH2	2.42	121.45	119.03

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	L	57	TRQ	4	0
2	M	57	TRQ	4	0

## 5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 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

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 [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	H	375/426 (88%)	-0.34	0 100 100	21, 37, 57, 71	0
1	J	375/426 (88%)	-0.32	1 (0%) 93 94	23, 37, 57, 72	0
2	L	124/188 (65%)	-0.29	1 (0%) 86 86	18, 33, 47, 63	0
2	M	124/188 (65%)	-0.29	1 (0%) 86 86	17, 31, 48, 62	0
3	A	106/132 (80%)	-0.04	5 (4%) 32 34	31, 44, 71, 83	0
3	B	106/132 (80%)	-0.23	2 (1%) 67 69	30, 43, 70, 83	0
All	All	1210/1492 (81%)	-0.29	10 (0%) 86 86	17, 38, 59, 83	0

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	B	1	GLN	3.1
3	B	19	ALA	3.0
3	A	7	THR	2.8
3	A	1	GLN	2.7
3	A	15	ALA	2.4

### 6.2 Non-standard residues in protein, DNA, RNA chains [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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
2	TRQ	L	57	16/17	0.96	0.16	-	25,26,30,31	0
2	TRQ	M	57	16/17	0.95	0.15	-	25,27,31,32	0

### 6.3 Carbohydrates [i](#)

There are no carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
4	CU	A	107	1/1	0.99	0.09	-2.52	34,34,34,34	0
4	CU	B	107	1/1	0.99	0.09	-4.18	38,38,38,38	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.