



Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 3O2U
Title : S. cerevisiae Ubc12
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Deposited on : 2010-07-22
Resolution : 2.00 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

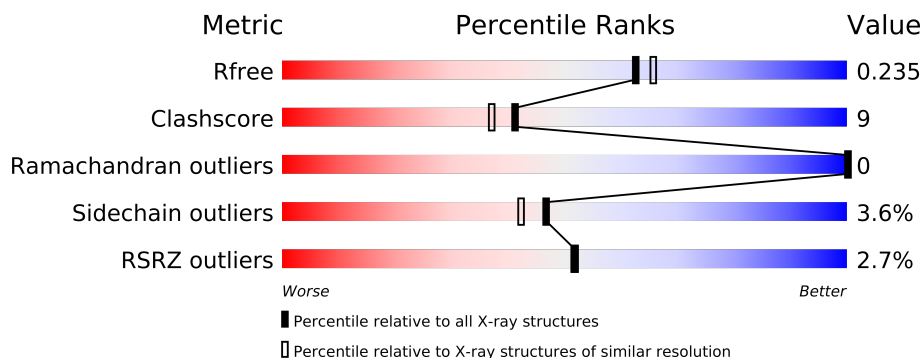
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance

The reported resolution of this entry is 2.00 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}	66092	4888 (2.00-2.00)
Clashscore	79885	6188 (2.00-2.00)
Ramachandran outliers	78287	6102 (2.00-2.00)
Sidechain outliers	78261	6100 (2.00-2.00)
RSRZ outliers	66119	4890 (2.00-2.00)

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 ≥ 3 , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	190	
1	B	190	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
2	GOL	A	3968	-	X
2	GOL	B	3968	-	X

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3104 atoms, of which 0 are hydrogen and 0 are deuterium.

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.

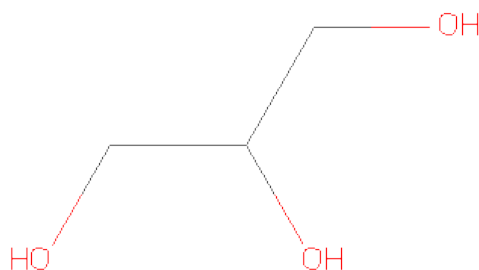
- Molecule 1 is a protein called NEDD8-conjugating enzyme UBC12.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	190	Total	C	N	O	S	0	2	0
			1503	953	256	289	5			
1	B	185	Total	C	N	O	S	0	0	0
			1423	905	241	273	4			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	999	GLY	-	EXPRESSION TAG	UNP P52491
A	1000	SER	-	EXPRESSION TAG	UNP P52491
B	999	GLY	-	EXPRESSION TAG	UNP P52491
B	1000	SER	-	EXPRESSION TAG	UNP P52491

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			6	3	3		
2	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	94	Total	O	0	0
			94	94		
3	B	72	Total	O	0	0
			72	72		

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	56.45Å 35.94Å 87.03Å 90.00° 90.64° 90.00°	Depositor
Resolution (Å)	25.92 – 2.00 47.60 – 2.00	Depositor EDS
% Data completeness (in resolution range)	98.2 (25.92-2.00) 98.1 (47.60-2.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.72 (at 2.00Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.5_2)	Depositor
R, R_{free}	0.185 , 0.233 0.189 , 0.235	Depositor DCC
R_{free} test set	1201 reflections (5.11%)	DCC
Wilson B-factor (Å ²)	27.7	Xtriage
Anisotropy	0.013	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 45.5	EDS
Estimated twinning fraction	0.022 for h,-k,-l	Xtriage
L-test for twinning	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 23526 reflections	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3104	wwPDB-VP
Average B, all atoms (Å ²)	31.0	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 31.16 % 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 1.1583e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 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	0.36	0/1538	0.56	0/2088
1	B	0.35	0/1451	0.54	0/1975
All	All	0.36	0/2989	0.55	0/4063

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1503	0	1516	24	0
1	B	1423	0	1401	31	0
2	A	6	0	8	1	0
2	B	6	0	8	2	0
3	A	94	0	0	1	0
3	B	72	0	0	1	0
All	All	3104	0	2933	54	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 9.

All (54) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:1097:VAL:O	2:B:3968:GOL:H31	1.66	0.96
1:B:1019:SER:O	1:B:1020:SER:HB3	1.67	0.94
1:A:1105:HIS:HD2	1:A:1107:ASN:H	1.21	0.87
1:B:1105:HIS:HD2	1:B:1107:ASN:H	1.25	0.84
1:B:1114:VAL:N	2:B:3968:GOL:O3	2.10	0.82
1:B:1116:LEU:HG	1:B:1118:ILE:HG22	1.61	0.80
1:A:1187:SER:HA	1:A:1188:PRO:O	1.83	0.78
1:A:1105:HIS:CD2	1:A:1107:ASN:H	2.07	0.71
1:A:1120:ARG:HB3	3:A:54:HOH:O	1.93	0.68
1:B:1169:ARG:HH11	1:B:1169:ARG:HG2	1.58	0.68
1:A:1180:VAL:HG22	1:A:1182:TYR:CE2	2.29	0.67
1:B:1103:ILE:HD11	1:B:1108:ILE:HD12	1.76	0.67
1:B:1046:THR:HG23	3:B:108:HOH:O	1.98	0.62
1:B:1033:LYS:HE2	1:B:1054:ASP:OD2	2.00	0.61
1:B:1172:MET:HG2	1:B:1185:ILE:HD11	1.82	0.61
1:B:1031:ARG:NH2	1:B:1127:LEU:O	2.32	0.60
1:A:1021:ILE:HD12	1:A:1021:ILE:O	2.00	0.60
1:A:1058:ARG:NH2	1:B:1122:ASP:OD1	2.34	0.59
1:B:1019:SER:O	1:B:1020:SER:CB	2.48	0.59
1:A:1103:ILE:HD11	1:A:1108:ILE:HD12	1.84	0.58
1:A:1051:THR:HG21	1:A:1060:GLN:HG3	1.85	0.56
1:B:1105:HIS:CD2	1:B:1107:ASN:H	2.15	0.55
1:A:1105:HIS:HE1	1:A:1139:LEU:O	1.89	0.55
1:B:1025:LEU:HD23	1:B:1058:ARG:NH1	2.24	0.51
1:A:1009:LYS:HD2	1:A:1013:LYS:HE2	1.93	0.51
1:A:1165:ALA:O	1:A:1169:ARG:HG3	2.11	0.50
1:B:1148:PRO:HB3	1:B:1154:ALA:HB2	1.93	0.49
1:A:1167:ALA:HB1	1:A:1177:ILE:HD11	1.94	0.49
1:B:1047:LEU:HD11	1:B:1064:LEU:HD13	1.95	0.49
1:A:1047:LEU:HD23	1:A:1047:LEU:C	2.34	0.47
1:A:1167:ALA:HB1	1:A:1177:ILE:CD1	2.44	0.47
1:B:1074:TYR:OH	1:B:1161:GLU:HG2	2.15	0.47
1:B:1003:LYS:HD2	1:B:1003:LYS:O	2.15	0.47
1:A:1036:LEU:HD13	2:A:3968:GOL:H12	1.97	0.47
1:A:1109:ASP:HB3	1:A:1149:LEU:HB3	1.97	0.46
1:A:1063:LYS:HG3	1:A:1085[A]:ASP:OD1	2.15	0.45
1:A:1090:TYR:CD1	1:A:1091:PRO:HA	2.51	0.45
1:B:1169:ARG:HG2	1:B:1169:ARG:NH1	2.28	0.45
1:B:1025:LEU:HD11	1:B:1054:ASP:HB3	1.98	0.44
1:A:1115:CYS:SG	1:A:1147:ASP:HB3	2.57	0.44
1:B:1152:ASP:O	1:B:1156:LEU:HD13	2.17	0.44
1:B:1109:ASP:HB3	1:B:1149:LEU:HB3	2.00	0.44

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:1104:PHE:CZ	1:B:1153:ALA:HA	2.52	0.43
1:A:1047:LEU:HD23	1:A:1048:ASN:N	2.33	0.43
1:B:1031:ARG:HH21	1:B:1128:ASP:HB3	1.83	0.43
1:A:1109:ASP:OD2	1:A:1113:ASN:HB2	2.20	0.42
1:B:1090:TYR:CD1	1:B:1091:PRO:HA	2.54	0.42
1:B:1058:ARG:HG3	1:B:1058:ARG:HH11	1.84	0.42
1:A:1021:ILE:HD12	1:A:1021:ILE:C	2.41	0.41
1:B:1053:PRO:HA	1:B:1062:PRO:HG3	2.01	0.41
1:B:1169:ARG:CG	1:B:1169:ARG:HH11	2.31	0.41
1:B:1045:VAL:HG11	1:B:1133:ILE:CG2	2.51	0.41
1:B:1186:VAL:HG12	1:B:1186:VAL:O	2.21	0.40
1:A:1001:MET:O	1:A:1005:ARG:HG3	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone ⓘ

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	190/190 (100%)	185 (97%)	5 (3%)	0	100	100
1	B	181/190 (95%)	178 (98%)	3 (2%)	0	100	100
All	All	371/380 (98%)	363 (98%)	8 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution. The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	173/174 (99%)	168 (97%)	5 (3%)	55	52

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	158/174 (91%)	151 (96%)	7 (4%)	39	32
All	All	331/348 (95%)	319 (96%)	12 (4%)	47	42

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1009	LYS
1	A	1013	LYS
1	A	1089	VAL
1	A	1156	LEU
1	A	1180	VAL
1	B	1003	LYS
1	B	1007	LEU
1	B	1020	SER
1	B	1047	LEU
1	B	1124	SER
1	B	1159	GLU
1	B	1169	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1022	GLN
1	A	1024	ASN
1	A	1105	HIS
1	B	1048	ASN
1	B	1105	HIS
1	B	1146	ASN

5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	GOL	A	3968	-	5,5,5	0.32	0	5,5,5	0.18	0
2	GOL	B	3968	-	5,5,5	0.52	0	5,5,5	0.65	0

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	GOL	A	3968	-	-	0/4/4/4	0/0/0/0
2	GOL	B	3968	-	-	0/4/4/4	0/0/0/0

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.

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, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	190/190 (100%)	-0.12	2 (1%) 77 78	15, 27, 47, 58	0
1	B	185/190 (97%)	0.03	8 (4%) 34 32	17, 30, 55, 66	0
All	All	375/380 (98%)	-0.05	10 (2%) 52 52	15, 28, 51, 66	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	1056	ALA	4.9
1	A	1188	PRO	4.1
1	B	1159	GLU	3.8
1	B	1019	SER	3.6
1	B	1004	LEU	3.0
1	B	1186	VAL	2.3
1	B	1018	SER	2.3
1	B	1007	LEU	2.3
1	B	1005	ARG	2.1
1	A	1056	ALA	2.1

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

Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors(Å ²)	Q<0.9
2	GOL	B	3968	6/6	0.23	8.08	21,35,39,45	0
2	GOL	A	3968	6/6	0.19	4.35	34,36,38,39	0

6.5 Other polymers

There are no such residues in this entry.