WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB EM Validation Report ⓘ

Mar 6, 2025 – 01:43 pm GMT

PDB ID	:	7ODE
EMDB ID	:	EMD-12826
Title	:	E. coli 50S ribosome LiCl core particle
Authors	:	Larsson, D.S.D.; Selmer, M.
Deposited on	:	2021-04-29
Resolution	:	2.84 Å(reported)
Based on initial model	:	4YBB

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 2.84 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	Percentile Ranks	Value
Clashscore		3
Ramachandran outliers		0
Sidechain outliers		4.2%
RNA backbone		0.65

Worse   *Better*

▮ Percentile relative to all structures

▯ Percentile relative to all EM structures
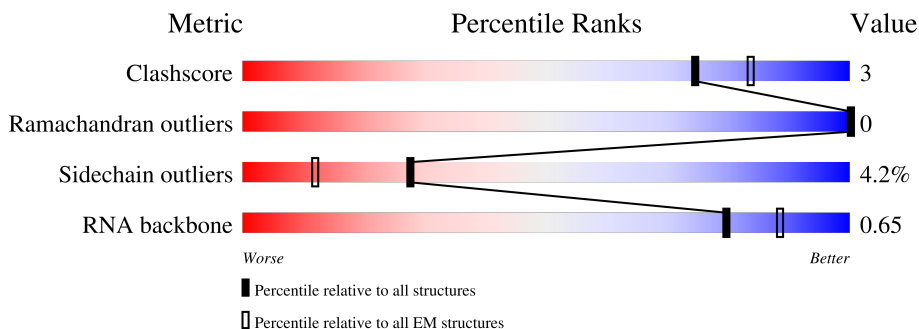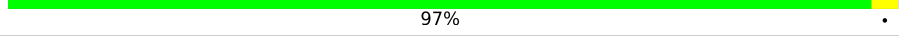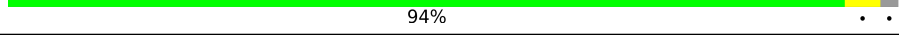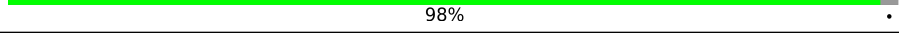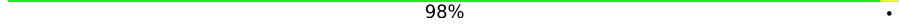
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415
RNA backbone	6643	2191

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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%

Mol	Chain	Length	Quality of chain
1	I	2904	55% 12% · 31%
2	K	273	68% 14% · 17%
3	L	209	78% 10% 12%
4	M	201	63% 18% · 18%
5	R	142	87% 13%
6	S	123	87% 12% ·
7	V	127	82% 12% · 6%

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Mol	Chain	Length	Quality of chain
8	X	115	90% 9%
9	Y	118	86% 12%
10	Z	103	86% 14%
11	a	110	97%
12	b	100	90% 7%
13	c	104	94%
14	g	63	98%
15	i	57	89% 9%
16	k	46	98%

2 Entity composition ⓘ

There are 16 unique types of molecules in this entry. The entry contains 92569 atoms, of which 36041 are hydrogens and 0 are deuteriums.

In the tables below, 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 RNA chain called 23S rRNA.

Mol	Chain	Residues	Atoms						AltConf	Trace
1	I	1990	Total 64256	C 19077	H 21509	N 7915	O 13771	P 1984	0	0

- Molecule 2 is a protein called 50S ribosomal protein L2.

Mol	Chain	Residues	Atoms						AltConf	Trace
2	K	226	Total 3509	C 1066	H 1788	N 344	O 304	S 7	0	0

- Molecule 3 is a protein called 50S ribosomal protein L3.

Mol	Chain	Residues	Atoms						AltConf	Trace
3	L	183	Total 2813	C 869	H 1438	N 247	O 255	S 4	0	0

- Molecule 4 is a protein called 50S ribosomal protein L4.

Mol	Chain	Residues	Atoms						AltConf	Trace
4	M	165	Total 2619	C 809	H 1337	N 225	O 243	S 5	0	0

- Molecule 5 is a protein called 50S ribosomal protein L13.

Mol	Chain	Residues	Atoms						AltConf	Trace
5	R	142	Total 2291	C 714	H 1162	N 212	O 199	S 4	0	0

- Molecule 6 is a protein called 50S ribosomal protein L14.

Mol	Chain	Residues	Atoms						AltConf	Trace
6	S	122	Total 1950	C 587	H 1012	N 180	O 165	S 6	0	0

- Molecule 7 is a protein called 50S ribosomal protein L17.

Mol	Chain	Residues	Atoms						AltConf	Trace
7	V	120	Total	C	H	N	O	S	0	0
			1960	593	1000	196	166	5		

- Molecule 8 is a protein called 50S ribosomal protein L19.

Mol	Chain	Residues	Atoms						AltConf	Trace
8	X	114	Total	C	H	N	O	S	0	0
			1879	574	962	179	163	1		

- Molecule 9 is a protein called 50S ribosomal protein L20.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	Y	117	Total	C	H	N	O	0	0
			1967	604	1020	192	151		

- Molecule 10 is a protein called 50S ribosomal protein L21.

Mol	Chain	Residues	Atoms						AltConf	Trace
10	Z	103	Total	C	H	N	O	S	0	0
			1655	516	839	153	145	2		

- Molecule 11 is a protein called 50S ribosomal protein L22.

Mol	Chain	Residues	Atoms						AltConf	Trace
11	a	110	Total	C	H	N	O	S	0	0
			1779	532	922	166	156	3		

- Molecule 12 is a protein called 50S ribosomal protein L23.

Mol	Chain	Residues	Atoms						AltConf	Trace
12	b	93	Total	C	H	N	O	S	0	0
			1545	466	807	139	131	2		

- Molecule 13 is a protein called 50S ribosomal protein L24.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	c	102	Total	C	H	N	O	0	0
			1612	492	833	146	141		

- Molecule 14 is a protein called 50S ribosomal protein L29.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
14	g	62	1032	308	531	98	94	1	0	0

- Molecule 15 is a protein called 50S ribosomal protein L32.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
15	i	56	907	269	463	94	80	1	0	0

- Molecule 16 is a protein called 50S ribosomal protein L34.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
16	k	46	795	228	418	90	57	2	0	0

3　Residue-property plots ⓘ

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. 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. 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: 23S rRNA

• Molecule 2: 50S ribosomal protein L2

Chain K: 68%   14%   •   17%

MET A2 P11 V16 P29 L34 K39 R43 R48 H58 D66 F67 K71 Y83 D84 R87 K97 D98 R102 L105 A106 P107 L110 K111 D114 Q115 L130 K150 A155 V162 Q163 I164 L174 M181 V184 E185

L192 G193 V204 L205 G206 R212 R217 V220 P227 VAL ASP HIS PRO HIS GLY GLY GLU GLY ARG ASN PHE GLY LYS HIS PRO VAL THR PRO TRP GLY VAL GLN THR LYS GLY LYS LYS THR ARG SER ASN LYS ARG THR ASP LYS PHE ILE VAL ARG ARG ARG SER

LYS

• Molecule 3: 50S ribosomal protein L3

Chain L: 78%   10%   12%

M1 I22 P23 V24 T25 K38 D39 R46 R59 V60 E81 V104 K105 G115 F118 N126 F127 ARG THR GLN ASP ALA THR HIS GLY ASN SER LEU SER HIS ARG VAL PRO GLY SER ILE GLY GLN ASN MEQ THR PRO GLY K154 V170 T171 V172 L175

L186 V193 A209
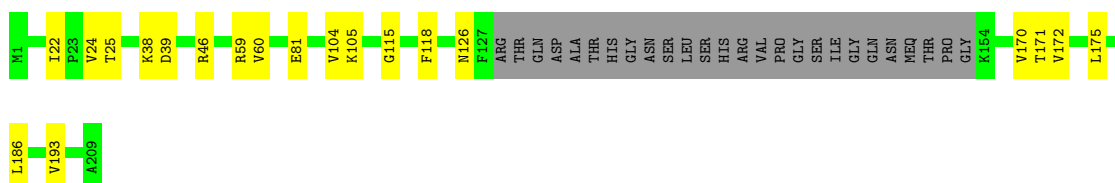
• Molecule 4: 50S ribosomal protein L4

Chain M: 63%   18%   •   18%

M1 L5 K6 D7 A8 Q9 L12 T13 V14 S15 E16 F19 G20 R21 Y35 T43 K47 THR ARG ALA GLU VAL THR GLY SER GLY LYS LYS PRO TRP ARG GLN LYS GLY THR GLY ARG ALA ARG SER GLY SER ILE LYS SER PRO ILE TRP ARG SER GLY GLY VAL T84

V96 I108 L109 L118 E122 V126 T131 L134 L147 I148 I149 T150 A160 D168 V169 R170 D171 A172 D176 P177 V178 M188 T189 A192 V196 E197 E198 M199 L200 A201

• Molecule 5: 50S ribosomal protein L13

Chain R: 87%   13%

M1 V18 T30 D49 V56 T65 Y75 I84 E102 M108 L109 P110 L114 G115 V124 Y125 N128 H132 A133 A134 L140 D141 I142

• Molecule 6: 50S ribosomal protein L14

Chain S: 87%   12%   •

M1 V10 A11 D12 N13 S14 V24 I41 T42 L58 R64 D80 L86 L87 V103 R108 I116 V122 LEU

• Molecule 7: 50S ribosomal protein L17

Chain V: 82%   12%   •   6%

M1 E49 T53 K56 A66 T70 N73 A77 N81 R90 Y94 T95 L98 D106 Y112 V116 E120 LYS ALA GLU ALA ALA GLU
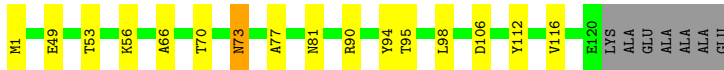
• Molecule 8: 50S ribosomal protein L19

Chain X: 90% 9%

MET S2 L8 E9 Q10 V17 R39 K63 E68 R103 K106 I110 K111 N115

• Molecule 9: 50S ribosomal protein L20

Chain Y: 86% 12%

MET A2 R3 V4 I9 L18 V31 D49 K54 R58 R70 Q71 S77 K78 F79 L83 E89 D97 V104 L117 A118

• Molecule 10: 50S ribosomal protein L21

Chain Z: 86% 14%

M1 Y2 A3 Q11 I41 E45 K48 V63 R68 R78 R79 Y83 R84 K85 Q86 V96 A103

• Molecule 11: 50S ribosomal protein L22

Chain a: 97%

M1 E2 H7 I66 R110

• Molecule 12: 50S ribosomal protein L23

Chain b: 90% 7%

M1 M24 Q72 L93 ASP PHE VAL GLY GLY ALA GLU
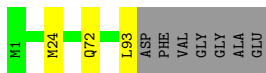
• Molecule 13: 50S ribosomal protein L24

Chain c: 94%

MET A2 R6 R7 R86 D89 I103 LYS

• Molecule 14: 50S ribosomal protein L29
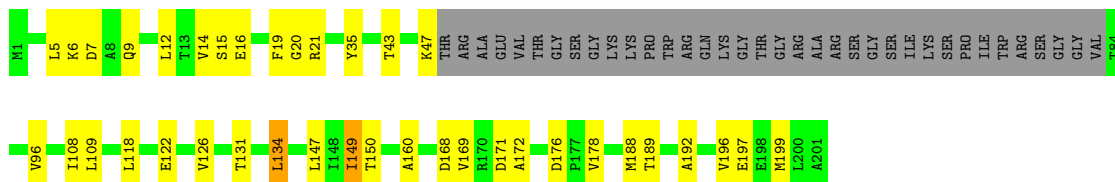
Chain g: 98%

• Molecule 15: 50S ribosomal protein L32

Chain i:

89% 9%

• Molecule 16: 50S ribosomal protein L34

Chain k:

98%

4 Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	384374	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{Å}^2)$	42	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	75000	Depositor
Image detector	FEI FALCON III (4k x 4k)	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: PSU, 1MG, 5MU

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	I	0.26	0/47771	0.67	0/74478
2	K	0.25	0/1750	0.56	0/2356
3	L	0.26	0/1391	0.51	0/1867
4	M	0.24	0/1294	0.46	0/1741
5	R	0.25	0/1152	0.49	0/1551
6	S	0.25	0/947	0.55	0/1268
7	V	0.25	0/973	0.56	0/1301
8	X	0.24	0/929	0.54	0/1242
9	Y	0.26	0/960	0.52	0/1278
10	Z	0.26	0/829	0.54	0/1107
11	a	0.25	0/864	0.54	0/1156
12	b	0.25	0/744	0.50	0/994
13	c	0.25	0/787	0.51	0/1051
14	g	0.22	0/502	0.50	0/667
15	i	0.24	0/450	0.57	0/599
16	k	0.26	0/380	0.66	0/498
All	All	0.26	0/61723	0.64	0/93154

There are no bond length outliers.

There are no bond angle outliers.

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	I	42747	21509	21541	127	0
2	K	1721	1788	1788	25	0
3	L	1375	1438	1437	14	0
4	M	1282	1337	1336	25	0
5	R	1129	1162	1162	10	0
6	S	938	1012	1012	8	0
7	V	960	1000	1000	11	0
8	X	917	962	962	5	0
9	Y	947	1020	1019	13	0
10	Z	816	839	839	6	0
11	a	857	922	922	0	0
12	b	738	807	807	0	0
13	c	779	833	831	0	0
14	g	501	531	531	0	0
15	i	444	463	458	0	0
16	k	377	418	418	0	0
All	All	56528	36041	36063	210	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 3.

All (210) 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:I:1667:G:O2'	1:I:1991:U:O4	1.95	0.85
1:I:1567:G:OP2	2:K:83:TYR:OH	1.98	0.82
1:I:1649:G:O2'	7:V:106:ASP:OD2	1.99	0.81
1:I:1296:G:OP1	1:I:2709:G:O2'	2.04	0.75
1:I:1715:G:O2'	1:I:1743:G:O6	2.04	0.74
2:K:29:PRO:HG2	2:K:34:LEU:HD11	1.70	0.74
1:I:1779:U:OP2	1:I:1784:A:N6	2.21	0.74
2:K:185:GLU:OE1	2:K:185:GLU:N	2.22	0.73
1:I:1154:G:OP2	9:Y:58:ARG:NH1	2.22	0.73
4:M:149:ILE:HD11	4:M:172:ALA:HA	1.72	0.72
1:I:1419:A:O2'	1:I:1421:G:N7	2.21	0.71
1:I:476:G:N1	1:I:479:A:OP2	2.25	0.70
1:I:276:U:O2'	1:I:278:A:N7	2.26	0.69
1:I:1450:G:N2	1:I:1452:G:O6	2.26	0.68
1:I:2659:G:N2	1:I:2662:A:OP2	2.25	0.68
8:X:110:ILE:HD12	8:X:110:ILE:O	1.93	0.68
1:I:1801:A:OP2	2:K:150:LYS:NZ	2.29	0.66
5:R:18:VAL:HG22	5:R:140:LEU:O	1.96	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:I:39:G:H1'	4:M:43:THR:HG21	1.80	0.64
1:I:974:G:O2'	1:I:989:G:N2	2.32	0.63
1:I:1688:U:O2'	1:I:1700:A:N7	2.30	0.63
4:M:171:ASP:OD1	4:M:172:ALA:N	2.31	0.63
1:I:956:G:N2	1:I:960:A:OP2	2.32	0.63
1:I:1250:G:H4'	9:Y:9:ILE:HD11	1.80	0.62
7:V:56:LYS:NZ	7:V:90:ARG:O	2.33	0.62
1:I:1754:A:O3'	8:X:103:ARG:NH2	2.33	0.62
5:R:75:TYR:HB3	5:R:84:ILE:HD11	1.81	0.62
1:I:1447:C:O2'	1:I:1544:A:N3	2.32	0.61
1:I:1654:A:O2'	3:L:118:PHE:O	2.18	0.61
1:I:2840:C:H5"	7:V:53:THR:HG21	1.82	0.61
4:M:131:THR:HG22	4:M:160:ALA:O	2.01	0.61
1:I:1426:G:O2'	1:I:1572:A:N6	2.31	0.60
4:M:118:LEU:HD11	4:M:188:MET:SD	2.40	0.60
1:I:1527:G:N1	1:I:1544:A:OP2	2.34	0.60
1:I:1250:G:C4'	9:Y:9:ILE:HD11	2.32	0.59
4:M:126:VAL:HG21	4:M:134:LEU:HD22	1.84	0.59
4:M:14:VAL:HG13	4:M:197:GLU:OE1	2.03	0.59
1:I:500:G:N1	1:I:503:A:OP2	2.36	0.58
2:K:67:PHE:CE1	2:K:105:LEU:HD21	2.38	0.58
1:I:324:A:N6	1:I:338:G:O2'	2.36	0.58
1:I:1785:A:HO2'	1:I:1786:A:H8	1.51	0.58
5:R:128:ASN:O	5:R:128:ASN:ND2	2.37	0.58
1:I:780:G:OP1	2:K:217:ARG:NH2	2.37	0.57
1:I:534:U:O2'	9:Y:49:ASP:OD2	2.14	0.57
1:I:586:A:N1	1:I:809:G:O2'	2.33	0.56
2:K:174:LEU:HD11	2:K:184:VAL:HG11	1.87	0.56
1:I:247:G:N2	1:I:251:A:OP2	2.39	0.56
9:Y:117:LEU:O	9:Y:117:LEU:HD23	2.05	0.56
1:I:475:C:O2	1:I:479:A:N6	2.32	0.55
2:K:192:LEU:HD13	2:K:193:GLY:N	2.22	0.54
1:I:190:A:N3	1:I:679:C:O2'	2.38	0.54
1:I:307:G:N1	1:I:310:A:OP2	2.40	0.53
2:K:67:PHE:HE1	2:K:105:LEU:HD21	1.73	0.53
1:I:998:C:OP2	9:Y:58:ARG:NH2	2.40	0.53
6:S:10:VAL:HG12	6:S:12:ASP:H	1.72	0.53
1:I:2627:G:O2'	1:I:2781:A:N1	2.32	0.53
7:V:73:ASN:OD1	7:V:73:ASN:N	2.35	0.53
1:I:242:G:O2'	1:I:254:G:O6	2.19	0.53
1:I:247:G:O2'	1:I:251:A:N6	2.41	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:I:1009:A:N3	1:I:1153:C:O2'	2.41	0.52
7:V:49:GLU:OE2	7:V:95:THR:HG22	2.09	0.52
6:S:64:ARG:NH1	8:X:68:GLU:OE1	2.43	0.52
1:I:852:U:O2	1:I:926:G:N1	2.44	0.51
1:I:2688:G:N1	1:I:2720:U:OP2	2.34	0.51
1:I:1631:G:N2	1:I:1634:A:OP2	2.39	0.51
10:Z:63:VAL:HA	10:Z:96:VAL:HG12	1.91	0.51
1:I:55:G:O2'	1:I:127:A:N1	2.36	0.51
1:I:2857:G:N2	1:I:2860:A:OP2	2.33	0.51
4:M:176:ASP:OD2	4:M:178:VAL:HG12	2.11	0.51
1:I:712:G:N2	1:I:720:U:O2'	2.43	0.51
1:I:271:G:O2'	1:I:272:A:P	2.69	0.51
7:V:66:ALA:O	7:V:70:THR:HG22	2.11	0.51
1:I:780:G:O2'	1:I:783:A:N6	2.44	0.51
1:I:2773:C:OP1	3:L:171:THR:OG1	2.26	0.51
4:M:168:ASP:OD1	4:M:169:VAL:N	2.44	0.51
1:I:310:A:O2'	1:I:311:A:OP2	2.25	0.51
2:K:39:LYS:NZ	2:K:58:HIS:O	2.28	0.51
4:M:149:ILE:HD11	4:M:172:ALA:CA	2.39	0.50
1:I:1792:G:H5"	2:K:204:VAL:HG13	1.92	0.50
1:I:1477:A:N6	1:I:1514:G:O2'	2.41	0.50
2:K:130:LEU:N	2:K:130:LEU:HD23	2.26	0.50
10:Z:83:TYR:O	10:Z:83:TYR:CG	2.65	0.50
1:I:1385:A:O2'	1:I:1396:U:O2	2.29	0.50
2:K:114:ASP:OD1	2:K:115:GLN:N	2.45	0.50
6:S:108:ARG:HG2	6:S:116:ILE:HD13	1.94	0.50
1:I:1999:C:O2	1:I:2687:U:O2'	2.26	0.49
1:I:1754:A:N1	1:I:2716:C:O2'	2.30	0.49
1:I:1792:G:C5'	2:K:204:VAL:HG13	2.42	0.49
1:I:2033:A:O2'	1:I:2035:G:OP2	2.23	0.49
4:M:192:ALA:O	4:M:196:VAL:HG23	2.13	0.49
5:R:56:VAL:HB	5:R:124:VAL:HG12	1.94	0.49
1:I:1378:A:O2'	1:I:1380:G:OP2	2.30	0.49
1:I:2635:A:O2'	3:L:81:GLU:OE2	2.25	0.49
3:L:186:LEU:HD21	8:X:8:LEU:HD21	1.93	0.49
1:I:2646:C:OP2	1:I:2732:G:O2'	2.30	0.49
3:L:22:ILE:O	3:L:24:VAL:HG13	2.12	0.49
4:M:14:VAL:HG11	4:M:19:PHE:CE1	2.47	0.49
1:I:2202:U:HO2'	1:I:2204:G:P	2.34	0.49
9:Y:89:GLU:O	10:Z:11:GLN:NE2	2.41	0.49
9:Y:79:PHE:CZ	9:Y:83:LEU:HD11	2.48	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:L:172:VAL:HG12	3:L:175:LEU:HD21	1.95	0.48
4:M:14:VAL:HG11	4:M:19:PHE:HE1	1.78	0.48
1:I:372:G:O2'	1:I:373:U:OP2	2.31	0.47
1:I:1141:U:OP2	5:R:65:THR:OG1	2.17	0.47
1:I:2821:A:OP2	3:L:115:GLY:N	2.47	0.47
1:I:1141:U:H4'	1:I:1142:A:O4'	2.14	0.47
1:I:2831:G:N7	3:L:59:ARG:NH2	2.62	0.47
5:R:102:GLU:HG3	5:R:124:VAL:HG21	1.97	0.47
1:I:280:U:O4	1:I:361:G:N2	2.47	0.47
1:I:927:A:H2'	1:I:928:A:O4'	2.15	0.47
1:I:1199:U:H1'	9:Y:4:VAL:HG22	1.97	0.47
1:I:1363:C:O2'	1:I:1809:A:N3	2.41	0.47
1:I:782:A:N7	2:K:220:VAL:HG21	2.30	0.47
3:L:38:LYS:NZ	3:L:81:GLU:OE2	2.43	0.47
1:I:39:G:C1'	4:M:43:THR:HG21	2.44	0.47
1:I:57:C:H2'	1:I:58:G:O4'	2.15	0.47
1:I:2655:G:HO2'	1:I:2664:G:H1	1.63	0.46
6:S:41:ILE:HD11	6:S:86:LEU:HD22	1.97	0.46
4:M:7:ASP:OD1	4:M:7:ASP:N	2.48	0.46
1:I:2820:A:O2'	1:I:2821:A:OP1	2.32	0.46
7:V:98:LEU:O	7:V:112:TYR:N	2.46	0.46
1:I:299:A:N3	1:I:319:G:O2'	2.47	0.46
1:I:1223:G:OP2	10:Z:68:ARG:NH2	2.48	0.46
1:I:974:G:O4'	1:I:990:A:N6	2.48	0.46
1:I:1011:G:P	9:Y:77:SER:HG	2.39	0.46
6:S:14:SER:OG	6:S:86:LEU:HD12	2.16	0.46
1:I:573:U:H1'	1:I:2033:A:C5	2.50	0.46
4:M:189:THR:HG23	4:M:192:ALA:H	1.81	0.46
1:I:493:G:H2'	1:I:494:G:O4'	2.17	0.45
2:K:71:LYS:NZ	2:K:98:ASP:OD2	2.49	0.45
10:Z:3:ALA:HB2	10:Z:41:ILE:HD13	1.97	0.45
2:K:105:LEU:H	2:K:105:LEU:HD22	1.82	0.45
4:M:126:VAL:HG21	4:M:134:LEU:CD2	2.45	0.45
1:I:226:A:O2'	1:I:229:C:N4	2.48	0.45
1:I:567:U:H3	1:I:574:A:H61	1.64	0.45
1:I:1266:G:O2'	1:I:2012:G:O6	2.16	0.45
1:I:1315:C:O2'	1:I:1392:A:N3	2.40	0.45
3:L:25:THR:HG21	3:L:193:VAL:HG22	1.99	0.45
4:M:5:LEU:HD23	4:M:122:GLU:HG3	1.99	0.45
1:I:1755:A:N6	1:I:2694:G:O2'	2.50	0.44
1:I:2051:A:H61	1:I:2614:A:H2'	1.82	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:K:107:PRO:HD2	2:K:110:LEU:HD22	1.99	0.44
1:I:58:G:O2'	1:I:73:A:N1	2.40	0.44
3:L:104:VAL:O	3:L:105:LYS:CG	2.66	0.44
6:S:116:ILE:HG23	6:S:122:VAL:HG21	1.98	0.44
1:I:482:A:O2'	1:I:497:A:N1	2.44	0.44
1:I:603:A:N1	1:I:625:G:O2'	2.46	0.44
3:L:60:VAL:O	3:L:60:VAL:HG13	2.17	0.44
3:L:104:VAL:O	3:L:105:LYS:HG2	2.18	0.44
1:I:1223:G:N2	1:I:1226:A:OP2	2.48	0.44
1:I:1307:A:N6	1:I:1606:C:O2'	2.51	0.44
7:V:90:ARG:NH2	7:V:116:VAL:HG11	2.33	0.44
1:I:1003:G:O2'	1:I:1010:A:N1	2.36	0.43
1:I:2850:A:N7	1:I:2868:A:O2'	2.36	0.43
1:I:414:C:H2'	1:I:415:A:O4'	2.18	0.43
5:R:49:ASP:HB3	5:R:114:LEU:HD11	2.00	0.43
1:I:12:U:O2	1:I:2626:C:H4'	2.19	0.43
1:I:2033:A:HO2'	1:I:2035:G:P	2.40	0.43
1:I:1394:U:H4'	1:I:1603:A:H4'	2.00	0.43
4:M:16:GLU:O	4:M:20:GLY:N	2.50	0.43
4:M:108:ILE:HD12	4:M:109:LEU:N	2.34	0.43
1:I:2723:C:H2'	1:I:2724:U:O4'	2.19	0.42
4:M:96:VAL:HG23	4:M:96:VAL:O	2.19	0.42
4:M:6:LYS:O	4:M:9:GLN:NE2	2.52	0.42
1:I:1240:U:O2'	1:I:1241:A:O5'	2.34	0.42
1:I:1329:U:OP2	1:I:1330:C:N4	2.49	0.42
2:K:164:ILE:HD12	2:K:164:ILE:N	2.34	0.42
1:I:1139:G:O2'	1:I:1143:A:N1	2.37	0.42
1:I:227:A:N6	1:I:411:G:HO2'	2.18	0.42
1:I:359:G:H2'	1:I:360:U:O4'	2.20	0.42
4:M:14:VAL:HG12	4:M:15:SER:N	2.35	0.42
4:M:149:ILE:C	4:M:149:ILE:HD13	2.40	0.42
1:I:271:G:O2'	1:I:272:A:O5'	2.30	0.41
1:I:1792:G:O2'	1:I:1830:C:OP1	2.37	0.41
1:I:463:G:N2	1:I:466:A:OP2	2.47	0.41
1:I:729:G:N2	2:K:11:PRO:O	2.53	0.41
1:I:1338:G:O2'	1:I:1393:A:N1	2.45	0.41
1:I:308:G:O2'	1:I:329:G:N2	2.54	0.41
1:I:372:G:O2'	1:I:400:G:O6	2.37	0.41
1:I:605:G:N3	1:I:657:U:O2'	2.54	0.41
1:I:818:G:N1	1:I:1188:U:OP2	2.41	0.41
9:Y:104:VAL:HG11	10:Z:45:GLU:OE1	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:I:416:U:H2'	1:I:417:C:O4'	2.21	0.41
2:K:16:VAL:HG22	2:K:206:GLY:HA3	2.03	0.41
2:K:66:ASP:OD2	2:K:102:ARG:NH1	2.53	0.41
1:I:157:C:H2'	1:I:158:U:O4'	2.21	0.41
1:I:1604:C:O2'	1:I:1610:A:N1	2.43	0.41
2:K:155:ALA:HB2	2:K:162:VAL:HG23	2.02	0.41
3:L:175:LEU:HD22	3:L:175:LEU:N	2.36	0.41
1:I:1757:A:O2'	1:I:1758:U:OP1	2.28	0.41
1:I:2799:A:O2'	1:I:2800:A:H5"	2.21	0.41
4:M:149:ILE:HD13	4:M:150:THR:N	2.35	0.41
1:I:580:U:O3'	9:Y:31:VAL:HG13	2.20	0.40
1:I:774:G:OP1	2:K:48:ARG:NH2	2.47	0.40
1:I:2898:U:O2'	5:R:134:ALA:O	2.31	0.40
5:R:125:TYR:OH	5:R:132:HIS:NE2	2.42	0.40
7:V:1:MET:SD	7:V:1:MET:N	2.87	0.40
7:V:53:THR:HG22	7:V:94:TYR:OH	2.20	0.40
7:V:77:ALA:O	7:V:81:ASN:ND2	2.54	0.40
8:X:17:VAL:O	8:X:17:VAL:HG23	2.20	0.40
1:I:18:U:O2'	1:I:554:U:OP1	2.33	0.40
1:I:669:G:H2'	1:I:670:A:C8	2.57	0.40
2:K:84:ASP:OD2	2:K:87:ARG:NE	2.47	0.40
6:S:42:THR:HG23	6:S:42:THR:O	2.21	0.40
5:R:110:PRO:O	5:R:115:GLY:HA3	2.22	0.40
1:I:1223:G:N1	1:I:1226:A:OP2	2.48	0.40
1:I:36:G:N3	1:I:450:G:O2'	2.52	0.40
1:I:1012:U:OP2	9:Y:70:ARG:NH2	2.51	0.40
1:I:2741:A:N6	1:I:2763:G:O2'	2.54	0.40
6:S:24:VAL:HG23	6:S:24:VAL:O	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 PDB entries followed by that with respect to all EM entries.

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	
2	K	224/273 (82%)	220 (98%)	4 (2%)	0	100	100
3	L	179/209 (86%)	174 (97%)	5 (3%)	0	100	100
4	M	161/201 (80%)	160 (99%)	1 (1%)	0	100	100
5	R	140/142 (99%)	138 (99%)	2 (1%)	0	100	100
6	S	120/123 (98%)	118 (98%)	2 (2%)	0	100	100
7	V	118/127 (93%)	116 (98%)	2 (2%)	0	100	100
8	X	112/115 (97%)	108 (96%)	4 (4%)	0	100	100
9	Y	115/118 (98%)	115 (100%)	0	0	100	100
10	Z	101/103 (98%)	99 (98%)	2 (2%)	0	100	100
11	a	108/110 (98%)	105 (97%)	3 (3%)	0	100	100
12	b	91/100 (91%)	90 (99%)	1 (1%)	0	100	100
13	c	100/104 (96%)	94 (94%)	6 (6%)	0	100	100
14	g	60/63 (95%)	59 (98%)	1 (2%)	0	100	100
15	i	54/57 (95%)	53 (98%)	1 (2%)	0	100	100
16	k	44/46 (96%)	43 (98%)	1 (2%)	0	100	100
All	All	1727/1891 (91%)	1692 (98%)	35 (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 PDB entries followed by that with respect to all EM entries.

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	
2	K	178/218 (82%)	171 (96%)	7 (4%)	27	52
3	L	143/163 (88%)	139 (97%)	4 (3%)	38	64
4	M	138/165 (84%)	130 (94%)	8 (6%)	17	34
5	R	116/116 (100%)	113 (97%)	3 (3%)	41	67
6	S	103/104 (99%)	99 (96%)	4 (4%)	27	52
7	V	100/103 (97%)	99 (99%)	1 (1%)	73	87

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
8	X	99/100 (99%)	94 (95%)	5 (5%)	20	40
9	Y	89/90 (99%)	83 (93%)	6 (7%)	13	28
10	Z	84/84 (100%)	78 (93%)	6 (7%)	12	26
11	a	93/93 (100%)	90 (97%)	3 (3%)	34	59
12	b	80/84 (95%)	77 (96%)	3 (4%)	28	53
13	c	83/85 (98%)	79 (95%)	4 (5%)	21	43
14	g	54/55 (98%)	54 (100%)	0	100	100
15	i	47/48 (98%)	42 (89%)	5 (11%)	5	11
16	k	38/38 (100%)	37 (97%)	1 (3%)	41	67
All	All	1445/1546 (94%)	1385 (96%)	60 (4%)	27	49

All (60) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	K	43	ARG
2	K	97	LYS
2	K	111	LYS
2	K	130	LEU
2	K	181	MET
2	K	192	LEU
2	K	212	ARG
3	L	39	ASP
3	L	46	ARG
3	L	126	ASN
3	L	170	VAL
4	M	12	LEU
4	M	21	ARG
4	M	35	TYR
4	M	47	LYS
4	M	134	LEU
4	M	147	LEU
4	M	149	ILE
4	M	199	MET
5	R	30	THR
5	R	108	MET
5	R	141	ASP
6	S	58	LEU
6	S	80	ASP
6	S	87	LEU

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Mol	Chain	Res	Type
6	S	103	VAL
7	V	73	ASN
8	X	10	GLN
8	X	39	ARG
8	X	63	LYS
8	X	106	LYS
8	X	111	LYS
9	Y	18	LEU
9	Y	54	LYS
9	Y	58	ARG
9	Y	70	ARG
9	Y	71	GLN
9	Y	97	ASP
10	Z	1	MET
10	Z	48	LYS
10	Z	78	ARG
10	Z	79	ARG
10	Z	84	ARG
10	Z	86	GLN
11	a	2	GLU
11	a	7	HIS
11	a	66	ILE
12	b	24	MET
12	b	72	GLN
12	b	93	LEU
13	c	6	ARG
13	c	7	ARG
13	c	86	ARG
13	c	89	ASP
15	i	3	VAL
15	i	10	ARG
15	i	27	SER
15	i	29	SER
15	i	38	HIS
16	k	24	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	I	1964/2904 (67%)	229 (11%)	1 (0%)

All (229) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	I	10	A
1	I	34	U
1	I	42	A
1	I	46	G
1	I	51	G
1	I	58	G
1	I	71	A
1	I	74	A
1	I	75	G
1	I	101	A
1	I	102	U
1	I	110	G
1	I	118	A
1	I	120	U
1	I	136	G
1	I	138	U
1	I	139	U
1	I	140	C
1	I	142	A
1	I	149	A
1	I	155	A
1	I	158	U
1	I	159	G
1	I	160	A
1	I	163	C
1	I	181	A
1	I	201	C
1	I	216	A
1	I	222	A
1	I	247	G
1	I	251	A
1	I	264	C
1	I	265	A
1	I	266	G
1	I	272	A
1	I	276	U
1	I	278	A
1	I	279	A

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Mol	Chain	Res	Type
1	I	285	G
1	I	287	G
1	I	294	A
1	I	311	A
1	I	324	A
1	I	329	G
1	I	330	A
1	I	345	A
1	I	353	C
1	I	357	C
1	I	361	G
1	I	362	A
1	I	371	A
1	I	372	G
1	I	396	G
1	I	415	A
1	I	424	G
1	I	451	U
1	I	456	C
1	I	481	G
1	I	491	G
1	I	505	A
1	I	509	C
1	I	510	C
1	I	531	C
1	I	532	A
1	I	549	G
1	I	562	U
1	I	572	A
1	I	573	U
1	I	574	A
1	I	587	C
1	I	603	A
1	I	613	A
1	I	614	A
1	I	615	U
1	I	616	A
1	I	621	A
1	I	686	U
1	I	712	G
1	I	719	C
1	I	720	U

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Mol	Chain	Res	Type
1	I	721	A
1	I	730	A
1	I	746	PSU
1	I	747	5MU
1	I	764	A
1	I	775	G
1	I	776	G
1	I	782	A
1	I	784	G
1	I	785	G
1	I	789	A
1	I	792	A
1	I	802	A
1	I	805	G
1	I	808	G
1	I	809	G
1	I	811	U
1	I	812	C
1	I	819	A
1	I	834	G
1	I	845	A
1	I	846	U
1	I	847	U
1	I	853	C
1	I	854	C
1	I	931	U
1	I	932	U
1	I	941	A
1	I	974	G
1	I	984	A
1	I	995	C
1	I	996	A
1	I	1005	C
1	I	1012	U
1	I	1013	C
1	I	1132	U
1	I	1133	A
1	I	1135	C
1	I	1139	G
1	I	1142	A
1	I	1170	C
1	I	1179	G

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Mol	Chain	Res	Type
1	I	1180	U
1	I	1206	G
1	I	1238	G
1	I	1241	A
1	I	1249	U
1	I	1252	G
1	I	1256	G
1	I	1265	A
1	I	1266	G
1	I	1271	G
1	I	1272	A
1	I	1300	G
1	I	1301	A
1	I	1302	A
1	I	1326	U
1	I	1329	U
1	I	1345	C
1	I	1352	U
1	I	1366	A
1	I	1368	G
1	I	1379	U
1	I	1383	A
1	I	1391	U
1	I	1416	G
1	I	1417	C
1	I	1421	G
1	I	1427	A
1	I	1428	C
1	I	1453	A
1	I	1460	U
1	I	1482	G
1	I	1486	U
1	I	1490	A
1	I	1493	C
1	I	1508	A
1	I	1509	A
1	I	1510	G
1	I	1515	A
1	I	1529	G
1	I	1534	U
1	I	1554	U
1	I	1566	A

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Mol	Chain	Res	Type
1	I	1569	A
1	I	1578	U
1	I	1608	A
1	I	1646	C
1	I	1647	U
1	I	1648	U
1	I	1669	A
1	I	1674	G
1	I	1715	G
1	I	1731	G
1	I	1733	G
1	I	1738	G
1	I	1764	C
1	I	1773	A
1	I	1791	A
1	I	1800	C
1	I	1801	A
1	I	1808	A
1	I	1816	C
1	I	1829	A
1	I	1972	G
1	I	1991	U
1	I	1993	U
1	I	1997	C
1	I	2022	U
1	I	2023	C
1	I	2029	G
1	I	2034	U
1	I	2043	C
1	I	2204	G
1	I	2611	C
1	I	2612	C
1	I	2613	U
1	I	2614	A
1	I	2629	U
1	I	2646	C
1	I	2653	U
1	I	2664	G
1	I	2665	A
1	I	2667	C
1	I	2689	U
1	I	2690	U

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Mol	Chain	Res	Type
1	I	2714	G
1	I	2726	A
1	I	2733	A
1	I	2744	G
1	I	2763	G
1	I	2777	G
1	I	2778	A
1	I	2791	G
1	I	2794	C
1	I	2798	U
1	I	2799	A
1	I	2800	A
1	I	2820	A
1	I	2821	A
1	I	2835	A
1	I	2867	G
1	I	2873	A
1	I	2880	C
1	I	2883	A
1	I	2884	U
1	I	2887	A
1	I	2901	C
1	I	2903	U

All (1) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	I	1240	U

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

4 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
1	1MG	I	745	1	18,26,27	1.01	1 (5%)	19,39,42	0.72	0
1	PSU	I	746	1	18,21,22	1.07	2 (11%)	22,30,33	1.46	2 (9%)
1	5MU	I	747	1	19,22,23	0.44	0	28,32,35	0.74	0
1	PSU	I	955	1	18,21,22	0.82	1 (5%)	22,30,33	1.45	2 (9%)

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
1	1MG	I	745	1	-	0/3/25/26	0/3/3/3
1	PSU	I	746	1	-	2/7/25/26	0/2/2/2
1	5MU	I	747	1	-	0/7/25/26	0/2/2/2
1	PSU	I	955	1	-	0/7/25/26	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	I	746	PSU	O4'-C1'	-3.08	1.39	1.43
1	I	955	PSU	C6-N1	-2.32	1.32	1.36
1	I	746	PSU	C6-N1	-2.31	1.32	1.36
1	I	745	1MG	C5-C4	-2.30	1.37	1.43

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	I	955	PSU	C6-N1-C2	4.94	127.74	122.68
1	I	746	PSU	C6-N1-C2	4.76	127.55	122.68
1	I	955	PSU	N1-C2-N3	-2.75	112.02	115.13
1	I	746	PSU	N1-C2-N3	-2.73	112.03	115.13

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	I	746	PSU	O4'-C4'-C5'-O5'
1	I	746	PSU	C3'-C4'-C5'-O5'

There are no ring outliers.

No monomer is involved in short contacts.

5.5　Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6　Ligand geometry ⓘ

There are no ligands in this entry.

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.