



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 29, 2024 – 04:47 PM EDT

PDB ID : 4OLL  
Title : cAMP-binding acyltransferase from Mycobacterium smegmatis  
Authors : Podobnik, M.; Rebolj, K.; Visweswariah, S.S.  
Deposited on : 2014-01-24  
Resolution : 1.90 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>.

---

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

MolProbity : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 1.20.1  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

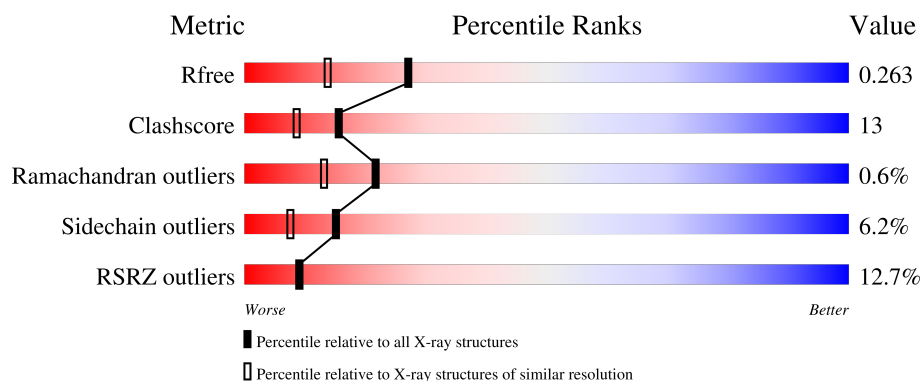
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 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	7293 (1.90-1.90)
Clashscore	180529	8090 (1.90-1.90)
Ramachandran outliers	177936	8022 (1.90-1.90)
Sidechain outliers	177891	8022 (1.90-1.90)
RSRZ outliers	164620	7292 (1.90-1.90)

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	340	<div> <div>11%</div> <div>69%</div> <div>21%</div> <div>• 7%</div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 2647 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 Acetyltransferase Pat.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	316	Total	C	N	O	S	Se	0	0	0
			2473	1582	437	444	1	9			

There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-6	GLY	-	expression tag	UNP A0R3F9
A	-5	ALA	-	expression tag	UNP A0R3F9
A	-3	ASP	-	expression tag	UNP A0R3F9
A	-2	PRO	-	expression tag	UNP A0R3F9
A	-1	GLY	-	expression tag	UNP A0R3F9
A	0	ASN	-	expression tag	UNP A0R3F9
A	1	VAL	-	expression tag	UNP A0R3F9

- Molecule 2 is MERCURY (II) ION (three-letter code: HG) (formula: Hg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Hg	0	0
			1	1		

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Ca	0	0
			2	2		

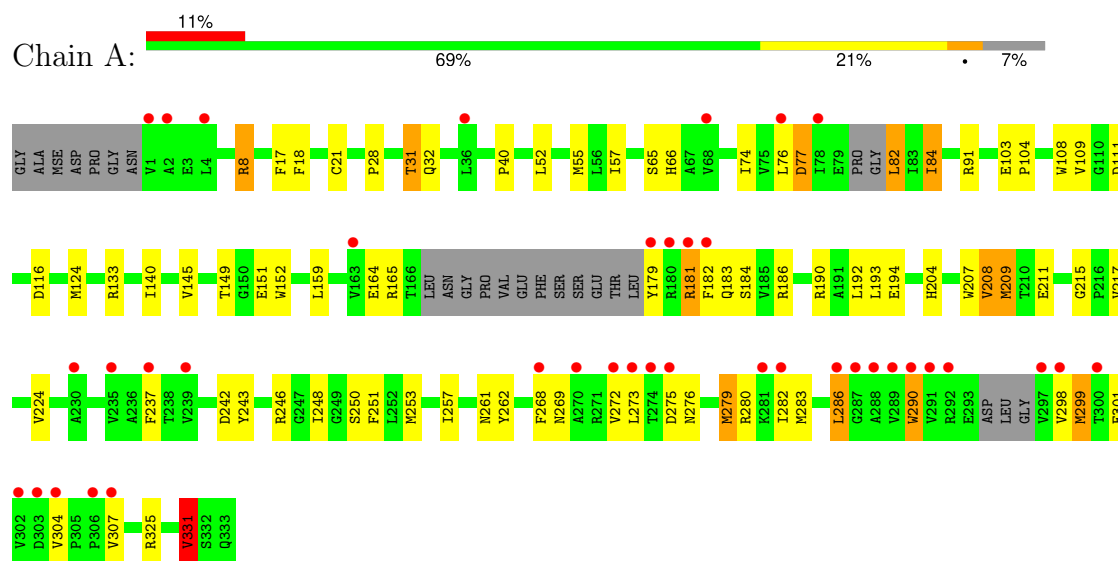
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	171	Total	O	0	0
			171	171		

### 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: Acetyltransferase Pat



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	38.30Å 82.75Å 105.51Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	65.11 – 1.90 65.11 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.1 (65.11-1.90) 99.2 (65.11-1.90)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.67 (at 1.89Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, $R_{free}$	0.206 , 0.263 0.206 , 0.263	Depositor DCC
$R_{free}$ test set	2703 reflections (10.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	33.9	Xtriage
Anisotropy	0.266	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 43.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	2647	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	54.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.24% of the height of the origin peak. No significant pseudotranslation is detected.*

<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: CA, HG

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	0.87	4/2513 (0.2%)	1.01	11/3404 (0.3%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	108	TRP	CD2-CE2	6.58	1.49	1.41
1	A	152	TRP	CD2-CE2	5.85	1.48	1.41
1	A	290	TRP	CD2-CE2	5.74	1.48	1.41
1	A	207	TRP	CD2-CE2	5.26	1.47	1.41

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	186	ARG	NE-CZ-NH2	-14.97	112.82	120.30
1	A	186	ARG	NE-CZ-NH1	14.21	127.40	120.30
1	A	190	ARG	NE-CZ-NH1	8.49	124.55	120.30
1	A	208	VAL	CG1-CB-CG2	5.50	119.70	110.90
1	A	209	MSE	CA-CB-CG	-5.46	104.01	113.30
1	A	331	VAL	CG1-CB-CG2	5.38	119.50	110.90
1	A	84	ILE	CG1-CB-CG2	-5.30	99.74	111.40
1	A	133	ARG	NE-CZ-NH2	-5.25	117.67	120.30
1	A	111	ASP	CB-CG-OD1	5.17	122.95	118.30
1	A	52	LEU	CB-CG-CD1	-5.16	102.23	111.00
1	A	279	MSE	CG-SE-CE	5.04	109.99	98.90

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	A	2473	0	2508	66	0
2	A	1	0	0	0	0
3	A	2	0	0	0	0
4	A	171	0	0	2	0
All	All	2647	0	2508	66	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 13.

All (66) 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:A:279:MSE:HE3	1:A:282:ILE:HB	1.27	1.13
1:A:57:ILE:HD11	1:A:84:ILE:CD1	1.87	1.04
1:A:57:ILE:HD11	1:A:84:ILE:HD12	1.39	1.02
1:A:204:HIS:CD2	1:A:224:VAL:HG22	2.11	0.85
1:A:237:PHE:HZ	1:A:253:MSE:SE	2.09	0.84
1:A:76:LEU:O	1:A:77:ASP:HB2	1.81	0.80
1:A:8:ARG:HG3	1:A:8:ARG:HH11	1.46	0.79
1:A:279:MSE:HE3	1:A:282:ILE:CB	2.12	0.76
1:A:272:VAL:HG11	1:A:279:MSE:HG2	1.66	0.75
1:A:8:ARG:HH11	1:A:8:ARG:CG	2.00	0.74
1:A:237:PHE:CZ	1:A:253:MSE:SE	2.93	0.71
1:A:57:ILE:HD11	1:A:84:ILE:HD11	1.70	0.70
1:A:66:HIS:NE2	4:A:641:HOH:O	2.27	0.67
1:A:290:TRP:HA	1:A:299:MSE:O	1.96	0.66
1:A:57:ILE:CD1	1:A:84:ILE:CD1	2.70	0.65
1:A:204:HIS:HD2	1:A:224:VAL:HG22	1.61	0.64
1:A:165:ARG:HH11	1:A:204:HIS:HD1	1.46	0.64
1:A:253:MSE:HE3	1:A:257:ILE:HG13	1.79	0.64
1:A:253:MSE:CE	1:A:257:ILE:HG13	2.28	0.63
1:A:279:MSE:CE	1:A:282:ILE:HB	2.19	0.63
1:A:262:TYR:OH	1:A:325:ARG:HG3	1.98	0.62
1:A:182:PHE:HB3	1:A:193:LEU:HD22	1.81	0.61
1:A:91:ARG:HH22	1:A:331:VAL:HG13	1.67	0.59

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:55:MSE:HG2	1:A:109:VAL:HG22	1.84	0.59
1:A:57:ILE:CD1	1:A:84:ILE:HD11	2.31	0.59
1:A:8:ARG:HG3	1:A:8:ARG:NH1	2.17	0.59
1:A:57:ILE:CD1	1:A:84:ILE:HD12	2.25	0.56
1:A:243:TYR:HB3	1:A:248:ILE:HD12	1.89	0.54
1:A:179:TYR:OH	1:A:194:GLU:OE2	2.27	0.51
1:A:149:THR:OG1	1:A:151:GLU:HG3	2.11	0.51
1:A:8:ARG:HH11	1:A:8:ARG:CB	2.24	0.50
1:A:17:PHE:CZ	1:A:124:MSE:CE	2.95	0.50
1:A:279:MSE:CE	1:A:282:ILE:CG2	2.90	0.49
1:A:165:ARG:NH1	1:A:204:HIS:HD1	2.08	0.49
1:A:182:PHE:CB	1:A:193:LEU:HD22	2.42	0.49
1:A:257:ILE:HG23	1:A:261:ASN:OD1	2.12	0.49
1:A:8:ARG:HH11	1:A:8:ARG:HB2	1.78	0.48
1:A:181:ARG:HH11	1:A:181:ARG:H	1.61	0.48
1:A:211:GLU:O	1:A:215:GLY:HA3	2.14	0.48
1:A:140:ILE:HD12	1:A:159:LEU:HD21	1.96	0.47
1:A:273:LEU:O	1:A:276:ASN:HB3	2.15	0.47
1:A:268:PHE:CE1	1:A:304:VAL:HG22	2.48	0.47
1:A:31:THR:HG22	1:A:32:GLN:HG3	1.97	0.47
1:A:279:MSE:HE2	1:A:283:MSE:SE	2.65	0.47
1:A:253:MSE:HE1	1:A:268:PHE:CE1	2.49	0.47
1:A:304:VAL:O	1:A:304:VAL:HG12	2.13	0.47
1:A:237:PHE:N	1:A:237:PHE:CD1	2.83	0.46
1:A:151:GLU:OE1	1:A:246:ARG:HD3	2.16	0.46
1:A:253:MSE:HE3	1:A:253:MSE:O	2.15	0.46
1:A:65:SER:HA	1:A:74:ILE:O	2.16	0.46
1:A:165:ARG:NH1	1:A:204:HIS:ND1	2.64	0.45
1:A:40:PRO:HG3	1:A:104:PRO:HD3	2.00	0.44
1:A:279:MSE:HE2	1:A:283:MSE:HG2	1.99	0.44
1:A:164:GLU:HG3	1:A:217:VAL:HG11	1.98	0.44
1:A:18:PHE:O	1:A:21:CYS:HB2	2.19	0.43
1:A:28:PRO:O	1:A:31:THR:HB	2.19	0.43
1:A:286:LEU:N	4:A:653:HOH:O	2.48	0.42
1:A:182:PHE:C	1:A:184:SER:H	2.22	0.42
1:A:145:VAL:HB	1:A:251:PHE:CZ	2.54	0.42
1:A:181:ARG:H	1:A:181:ARG:HD3	1.84	0.42
1:A:116:ASP:OD1	1:A:192:LEU:HG	2.21	0.41
1:A:279:MSE:HE1	1:A:282:ILE:CG2	2.50	0.41
1:A:82:LEU:HD12	1:A:82:LEU:O	2.21	0.41
1:A:145:VAL:HG21	1:A:209:MSE:SE	2.71	0.40

*Continued on next page...*



*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:103:GLU:HB3	1:A:104:PRO:HD2	2.03	0.40
1:A:209:MSE:HE2	1:A:248:ILE:HG23	2.03	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	308/340 (91%)	292 (95%)	14 (4%)	2 (1%)	22	13

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	77	ASP
1	A	183	GLN

### 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	260/268 (97%)	244 (94%)	16 (6%)	15	7

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	ARG
1	A	31	THR
1	A	82	LEU
1	A	181	ARG
1	A	208	VAL
1	A	242	ASP
1	A	250	SER
1	A	269	ASN
1	A	275	ASP
1	A	280	ARG
1	A	286	LEU
1	A	298	VAL
1	A	299	MSE
1	A	301	GLU
1	A	307	VAL
1	A	331	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	276	ASN

### 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 3 ligands modelled in this entry, 3 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 ⓘ

### 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<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	307/340 (90%)	0.72	39 (12%) 9 9	23, 48, 102, 146	0

All (39) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1	VAL	5.8
1	A	286	LEU	5.6
1	A	290	TRP	5.4
1	A	182	PHE	4.8
1	A	78	ILE	4.3
1	A	298	VAL	4.1
1	A	272	VAL	4.1
1	A	288	ALA	3.9
1	A	274	THR	3.6
1	A	273	LEU	3.4
1	A	2	ALA	3.4
1	A	282	ILE	3.4
1	A	76	LEU	3.2
1	A	289	VAL	3.2
1	A	307	VAL	3.2
1	A	179	TYR	3.2
1	A	297	VAL	3.1
1	A	180	ARG	2.9
1	A	230	ALA	2.8
1	A	181	ARG	2.7
1	A	68	VAL	2.5
1	A	235	VAL	2.5
1	A	163	VAL	2.4
1	A	287	GLY	2.3
1	A	291	VAL	2.3
1	A	237	PHE	2.3
1	A	268	PHE	2.3

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	A	281	LYS	2.3
1	A	304	VAL	2.3
1	A	292	ARG	2.2
1	A	4	LEU	2.2
1	A	270	ALA	2.2
1	A	302	VAL	2.1
1	A	239	VAL	2.1
1	A	300	THR	2.1
1	A	36	LEU	2.0
1	A	275	ASP	2.0
1	A	303	ASP	2.0
1	A	306	PRO	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 monosaccharides 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	CA	A	403	1/1	0.91	0.11	80,80,80,80	0
2	HG	A	401	1/1	0.96	0.07	75,75,75,75	1
3	CA	A	402	1/1	0.99	0.03	22,22,22,22	1

## 6.5 Other polymers [i](#)

There are no such residues in this entry.