



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 1, 2026 – 05:24 PM UTC

PDB ID : 5ZN7 / pdb_00005zn7
Title : Crystal structure of GH31 alpha-xylosidase from a soil metagenome complexed with xylose
Authors : Matsuzawa, T.; Nakamichi, Y.; Watanabe, M.; Yaoi, K.
Deposited on : 2018-04-07
Resolution : 2.10 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

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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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

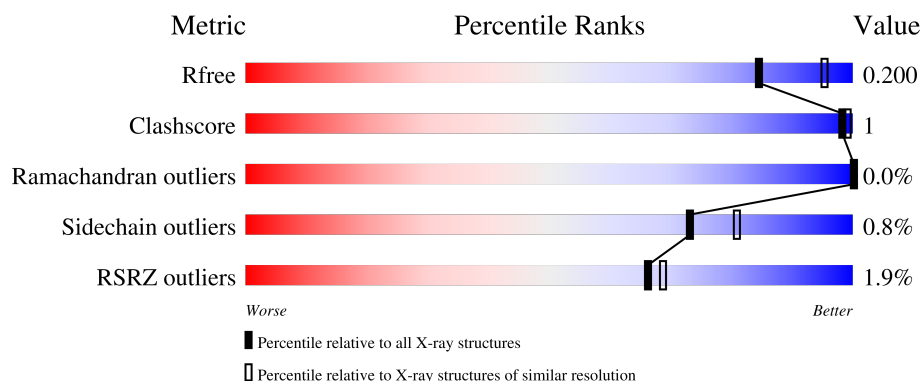
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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}	180053	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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 $\leq 5\%$. 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	687	% 96% ..
1	B	687	3% 98% ..
1	C	687	2% 96% ..
1	D	687	% 96% ..
1	E	687	% 96% ..

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Mol	Chain	Length	Quality of chain
1	F	687	3% 96%
1	G	687	2% 97%
1	H	687	% 95%

2 Entry composition

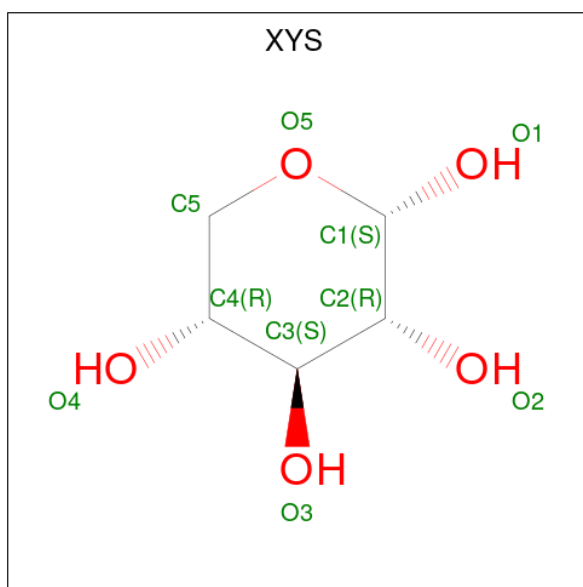
There are 3 unique types of molecules in this entry. The entry contains 47562 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 alpha-xylosidase MeXyl31.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	680	Total	C	N	O	S	0	3	0
			5477	3499	929	1016	33			
1	B	682	Total	C	N	O	S	0	0	0
			5474	3497	932	1013	32			
1	C	676	Total	C	N	O	S	0	3	0
			5447	3479	925	1011	32			
1	D	680	Total	C	N	O	S	0	2	0
			5468	3492	928	1016	32			
1	E	675	Total	C	N	O	S	0	1	0
			5429	3468	925	1004	32			
1	F	675	Total	C	N	O	S	0	0	0
			5418	3462	921	1003	32			
1	H	676	Total	C	N	O	S	0	1	0
			5430	3468	923	1007	32			
1	G	677	Total	C	N	O	S	0	0	0
			5432	3471	923	1006	32			

- Molecule 2 is alpha-D-xylopyranose (CCD ID: YYS) (formula: C₅H₁₀O₅).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			10	5	5		
2	C	1	Total	C	O	0	0
			10	5	5		
2	D	1	Total	C	O	0	0
			10	5	5		
2	F	1	Total	C	O	0	0
			10	5	5		
2	H	1	Total	C	O	0	0
			10	5	5		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	565	Total	O	0	0
			565	565		
3	B	467	Total	O	0	0
			467	467		
3	C	535	Total	O	0	0
			535	535		
3	D	527	Total	O	0	0
			527	527		
3	E	427	Total	O	0	0
			427	427		
3	F	408	Total	O	0	0
			408	408		
3	H	564	Total	O	0	0
			564	564		

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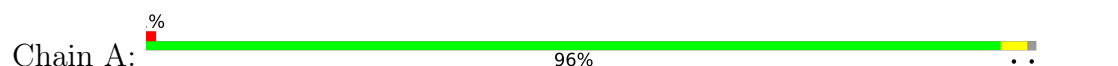
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	G	444	Total 444	O 444	0	0

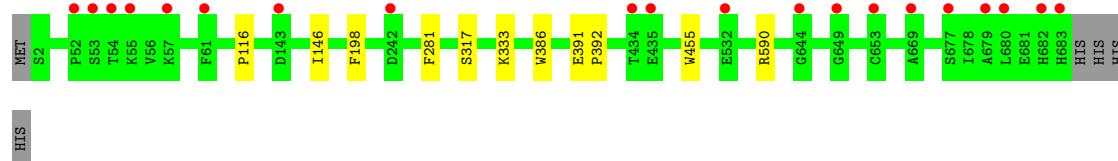
3 Residue-property plots [i](#)

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: alpha-xylosidase MeXyl31



- Molecule 1: alpha-xylosidase MeXyl31



- Molecule 1: alpha-xylosidase MeXyl31



- Molecule 1: alpha-xylosidase MeXyl31



- Molecule 1: alpha-xylosidase MeXyl31



Chain G:

Amino Acid	Frequency (%)
MET	2%
S2	97%
K19	97%
A34	97%
P62	97%
S53	97%
T54	97%
K55	97%
D143	97%
M170	97%
E266	97%
F281	97%
S317	97%
E327	97%
W386	97%
E391	97%
P392	97%
T434	97%
E435	97%
W455	97%
I506	97%
A531	97%
W550	97%
I559	97%
R590	97%
T643	97%
A674	97%
S677	97%
I678	97%
ALA	97%
LEU	97%
GLU	97%
HIS	97%
HIS	97%

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	173.91Å 124.86Å 177.72Å 90.00° 116.98° 90.00°	Depositor
Resolution (Å)	50.00 – 2.10 50.00 – 2.10	Depositor EDS
% Data completeness (in resolution range)	93.8 (50.00-2.10) 93.8 (50.00-2.10)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.83 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.8.0189	Depositor
R, R_{free}	0.165 , 0.191 0.176 , 0.200	Depositor DCC
R_{free} test set	18670 reflections (4.74%)	wwPDB-VP
Wilson B-factor (Å ²)	14.4	Xtriage
Anisotropy	0.104	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 36.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.000 for l,-k,h	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	47562	wwPDB-VP
Average B, all atoms (Å ²)	17.0	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 29.75 % 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 1.4694e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical 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: XYZ

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	0.51	0/5631	0.73	0/7654
1	B	0.51	0/5630	0.73	0/7653
1	C	0.51	0/5601	0.73	1/7613 (0.0%)
1	D	0.51	0/5622	0.73	0/7642
1	E	0.52	0/5583	0.72	1/7588 (0.0%)
1	F	0.52	0/5572	0.73	0/7574
1	G	0.52	0/5586	0.73	1/7593 (0.0%)
1	H	0.52	0/5584	0.73	2/7590 (0.0%)
All	All	0.52	0/44809	0.73	5/60907 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	281	PHE	N-CA-C	5.57	117.72	110.43
1	G	281	PHE	N-CA-C	5.41	117.51	110.43
1	H	281	PHE	N-CA-C	5.38	117.48	110.43
1	H	55	LYS	N-CA-C	5.34	119.28	112.87
1	E	281	PHE	N-CA-C	5.16	116.99	110.33

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	5477	0	5245	11	0
1	B	5474	0	5240	5	0
1	C	5447	0	5212	7	0
1	D	5468	0	5233	7	0
1	E	5429	0	5200	6	0
1	F	5418	0	5188	6	0
1	G	5432	0	5204	7	0
1	H	5430	0	5197	10	0
2	A	10	0	10	0	0
2	C	10	0	10	1	0
2	D	10	0	10	0	0
2	F	10	0	10	0	0
2	H	10	0	10	0	0
3	A	565	0	0	0	0
3	B	467	0	0	0	0
3	C	535	0	0	0	0
3	D	527	0	0	0	0
3	E	427	0	0	0	0
3	F	408	0	0	0	0
3	G	444	0	0	0	0
3	H	564	0	0	0	0
All	All	47562	0	41769	53	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 1.

The worst 5 of 53 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:E:24:PRO:HG3	1:E:56:VAL:HG21	1.90	0.52
1:A:396[B]:VAL:O	1:A:396[B]:VAL:HG23	2.10	0.52
1:C:458:ASP:OD1	2:C:701:XYS:O2	2.28	0.51
1:C:213[B]:LEU:C	1:C:213[B]:LEU:HD23	2.37	0.49
1:G:317:SER:HA	1:G:386:TRP:HB3	1.95	0.48

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	681/687 (99%)	664 (98%)	17 (2%)	0	100	100
1	B	680/687 (99%)	662 (97%)	18 (3%)	0	100	100
1	C	677/687 (98%)	659 (97%)	18 (3%)	0	100	100
1	D	680/687 (99%)	662 (97%)	18 (3%)	0	100	100
1	E	674/687 (98%)	655 (97%)	17 (2%)	2 (0%)	36	36
1	F	673/687 (98%)	656 (98%)	17 (2%)	0	100	100
1	G	675/687 (98%)	658 (98%)	17 (2%)	0	100	100
1	H	675/687 (98%)	659 (98%)	16 (2%)	0	100	100
All	All	5415/5496 (98%)	5275 (97%)	138 (2%)	2 (0%)	100	100

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	62	GLU
1	E	171	SER

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	566/570 (99%)	560 (99%)	6 (1%)	65	74
1	B	565/570 (99%)	562 (100%)	3 (0%)	81	88
1	C	563/570 (99%)	558 (99%)	5 (1%)	70	78

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	D	565/570 (99%)	559 (99%)	6 (1%)	65	74
1	E	560/570 (98%)	556 (99%)	4 (1%)	76	83
1	F	559/570 (98%)	555 (99%)	4 (1%)	76	83
1	G	561/570 (98%)	557 (99%)	4 (1%)	76	83
1	H	561/570 (98%)	555 (99%)	6 (1%)	65	74
All	All	4500/4560 (99%)	4462 (99%)	38 (1%)	73	81

5 of 38 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	178	MET
1	G	281	PHE
1	H	239	MET
1	H	590	ARG
1	G	590	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 29 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	287	GLN
1	G	405	HIS
1	E	287	GLN
1	H	497	ASN
1	D	648	ASN

5.3.3 RNA ⓘ

There are no RNA molecules 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 oligosaccharides in this entry.

5.6 Ligand geometry

5 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	XYS	C	701	-	10,10,10	0.67	0	14,14,14	0.84	0
2	XYS	H	701	-	10,10,10	0.68	0	14,14,14	0.73	0
2	XYS	F	701	-	10,10,10	0.70	0	14,14,14	0.73	0
2	XYS	A	701	-	10,10,10	0.75	0	14,14,14	1.03	2 (14%)
2	XYS	D	701	-	10,10,10	0.70	0	14,14,14	1.26	2 (14%)

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	XYS	C	701	-	-	-	0/1/1/1
2	XYS	H	701	-	-	-	0/1/1/1
2	XYS	F	701	-	-	-	0/1/1/1
2	XYS	A	701	-	-	-	0/1/1/1
2	XYS	D	701	-	-	-	1/1/1/1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	701	XYS	C5-O5-C1	2.94	118.56	112.46
2	A	701	XYS	C5-O5-C1	2.20	117.03	112.46
2	D	701	XYS	C5-C4-C3	2.06	112.64	109.64
2	A	701	XYS	O1-C1-C2	2.03	114.86	108.98

There are no chirality outliers.

There are no torsion outliers.

All (1) ring outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	701	XYS	C1-C2-C3-C4-C5-O5

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	701	XYS	1	0

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 [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, 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	680/687 (98%)	-0.37	8 (1%) 76 78	4, 12, 24, 47	3 (0%)
1	B	682/687 (99%)	-0.05	20 (2%) 53 56	9, 17, 34, 62	0
1	C	676/687 (98%)	-0.43	13 (1%) 66 69	3, 11, 22, 49	3 (0%)
1	D	680/687 (98%)	-0.27	8 (1%) 76 78	6, 14, 27, 51	2 (0%)
1	E	675/687 (98%)	-0.02	10 (1%) 72 74	9, 19, 32, 56	1 (0%)
1	F	675/687 (98%)	0.07	23 (3%) 48 50	11, 20, 38, 56	0
1	G	677/687 (98%)	-0.07	13 (1%) 66 69	9, 17, 34, 61	0
1	H	676/687 (98%)	-0.36	7 (1%) 79 81	5, 12, 23, 49	1 (0%)
All	All	5421/5496 (98%)	-0.19	102 (1%) 66 69	3, 15, 31, 62	10 (0%)

The worst 5 of 102 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	678	ILE	7.5
1	B	680	LEU	5.5
1	G	143	ASP	5.5
1	C	55	LYS	5.3
1	D	54	THR	4.7

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 oligosaccharides 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, 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	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	XYS	D	701	10/10	0.79	0.15	29,31,32,33	0
2	XYS	H	701	10/10	0.81	0.15	27,31,32,33	0
2	XYS	C	701	10/10	0.82	0.15	24,28,29,29	0
2	XYS	F	701	10/10	0.84	0.14	31,34,36,36	0
2	XYS	A	701	10/10	0.85	0.15	27,29,31,31	0

6.5 Other polymers

There are no such residues in this entry.