



# wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 9, 2024 – 01:18 pm GMT

PDB ID : 2CLB  
Title : The structure of the DPS-like protein from *Sulfolobus solfataricus* reveals a bacterioferritin-like di-metal binding site within a Dps- like dodecameric assembly  
Authors : Gauss, G.H.; Benas, P.; Wiedenheft, B.; Young, M.; Douglas, T.; Lawrence, C.M.  
Deposited on : 2006-04-26  
Resolution : 2.40 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

<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>.

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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	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
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

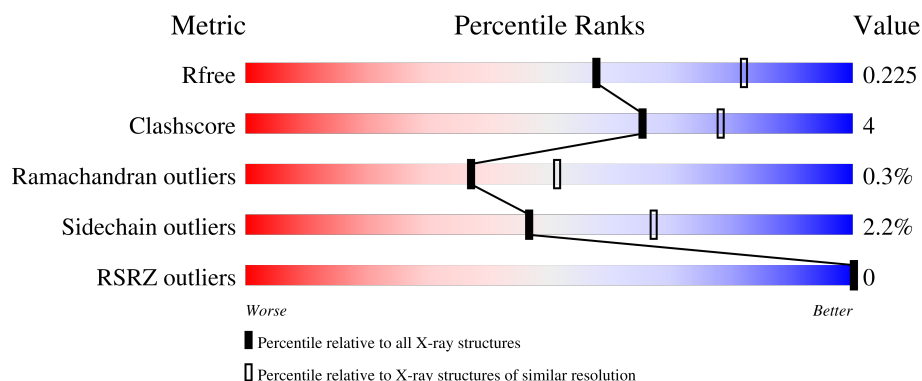
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*





The reported resolution of this entry is 2.40 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	4642 (2.40-2.40)
Clashscore	180529	5218 (2.40-2.40)
Ramachandran outliers	177936	5158 (2.40-2.40)
Sidechain outliers	177891	5159 (2.40-2.40)
RSRZ outliers	164620	4642 (2.40-2.40)

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	188	 82% 7% • 10%
1	B	188	 81% 7% • 11%
1	C	188	 79% 10% • 10%
1	D	188	 79% 10% • 11%

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Mol	Chain	Length	Quality of chain
1	M	188	 81%8% • 10%
1	N	188	 81%7% • 11%
1	O	188	 79%11% • 10%
1	P	188	 79%10% • 11%

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 11100 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 DPS-LIKE PROTEIN.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	169	Total	C	N	O	S	Se	0	0	0
			1376	878	229	262	3	4			
1	B	167	Total	C	N	O	S	Se	0	0	0
			1358	868	226	257	3	4			
1	C	169	Total	C	N	O	S	Se	0	0	0
			1376	878	229	262	3	4			
1	D	168	Total	C	N	O	S	Se	0	0	0
			1367	873	227	260	3	4			
1	M	169	Total	C	N	O	S	Se	0	0	0
			1376	878	229	262	3	4			
1	N	168	Total	C	N	O	S	Se	0	0	0
			1367	873	227	260	3	4			
1	O	169	Total	C	N	O	S	Se	0	0	0
			1376	878	229	262	3	4			
1	P	168	Total	C	N	O	S	Se	0	0	0
			1367	873	227	260	3	4			

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Zn	0	0
			1	1		
2	B	1	Total	Zn	0	0
			1	1		
2	C	1	Total	Zn	0	0
			1	1		
2	D	1	Total	Zn	0	0
			1	1		
2	M	1	Total	Zn	0	0
			1	1		
2	N	1	Total	Zn	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	O	1	Total 1	Zn 1	0	0
2	P	1	Total 1	Zn 1	0	0

- Molecule 3 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total 1	Fe 1	0	0
3	B	1	Total 1	Fe 1	0	0
3	C	1	Total 1	Fe 1	0	0
3	D	1	Total 1	Fe 1	0	0
3	M	1	Total 1	Fe 1	0	0
3	N	1	Total 1	Fe 1	0	0
3	O	1	Total 1	Fe 1	0	0
3	P	1	Total 1	Fe 1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	15	Total 15	O 15	0	0
4	B	12	Total 12	O 12	0	0
4	C	16	Total 16	O 16	0	0
4	D	16	Total 16	O 16	0	0
4	M	15	Total 15	O 15	0	0
4	N	14	Total 14	O 14	0	0
4	O	15	Total 15	O 15	0	0

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	P	18	Total	O	0	0
			18	18		



- Molecule 1: DPS-LIKE PROTEIN



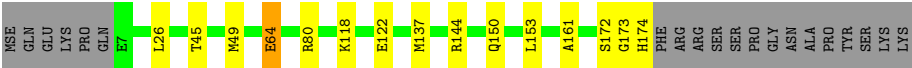
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|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| MSE | GLN | GLU | LYS | PRO | GLN | GLU | P8 | L26 | T45 | M49 | E64 | R80 | C101 | C126 | M137 | R144 | Q150 | L153 | A161 | S172 | G173 | H174 | PHE | ARG | ARG | SER | SER | PRO | PRO | GLY | ASN | ALA | PRO | TYR | SER | LYS | LYS |
|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

- |     |     |     |     |     |    |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| WSE | GLW | GLU | LYS | PRO | Q6 | V13 | I23 | L26 | T45 | M49 | E64 | R80 | C101 | K118 | E122 | C126 | M137 | R144 | Q150 | L153 | Q154 | A161 | S172 | G173 | H174 | PHE | ARG | ARG | SER | SER | PRO | GLY | ASN | ALA | PRO | TYR | SER | SER | LYS | LYS |
|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

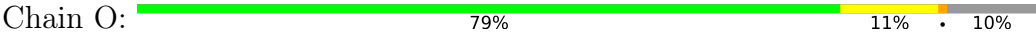
- |     |     |     |     |     |     |    |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| MSE | GLN | GLU | LYS | PRO | GLN | E7 | V13 | I23 | L26 | T45 | M49 | E64 | H73 | R80 | C101 | C126 | M137 | R144 | Q150 | L153 | Q154 | E155 | A161 | S172 | G173 | H174 | PHE | ARG | ARG | SER | SER | PRO | GLY | ASN | ALA | PRO | PRO | TVR | SER | LYS |
|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

- |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| MSE | GLN | L26 | T45 | M49 | E64 | R80 | C101 | E108 | C126 | M137 | R144 | Q150 | L153 | A161 | S172 | G173 | H174 | PHE | ARG | ARC | SER | SER | PRO | PRO | GLY | ASN | ALA | PRO | TTR | SER | Lys |
|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

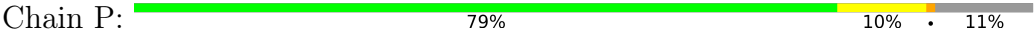
- Chain N:  81% 7% • 11%



● Molecule 1: DPS-LIKE PROTEIN



● Molecule 1: DPS-LIKE PROTEIN





## 4 Data and refinement statistics

Property	Value	Source
Space group	I 21 3	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	212.93Å 212.93Å 212.93Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.40 30.00 – 2.40	Depositor EDS
% Data completeness (in resolution range)	90.4 (30.00-2.40) 90.4 (30.00-2.40)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.13 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.199 , 0.222 0.201 , 0.225	Depositor DCC
$R_{free}$ test set	2891 reflections (5.23%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	38.7	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 30.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.488 for -l,-k,-h	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	11100	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.42% 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 [i](#)

### 5.1 Standard geometry [i](#)

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

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	0.34	0/1399	0.48	0/1882
1	B	0.34	0/1381	0.50	0/1857
1	C	0.36	0/1399	0.51	0/1882
1	D	0.37	0/1390	0.51	0/1870
1	M	0.35	0/1399	0.49	0/1882
1	N	0.35	0/1390	0.50	0/1870
1	O	0.36	0/1399	0.50	0/1882
1	P	0.37	0/1390	0.51	0/1870
All	All	0.35	0/11147	0.50	0/14995

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 [i](#)

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	1376	0	1370	8	0
1	B	1358	0	1357	9	0
1	C	1376	0	1370	16	0
1	D	1367	0	1362	11	0
1	M	1376	0	1370	9	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	N	1367	0	1362	8	0
1	O	1376	0	1370	14	0
1	P	1367	0	1362	11	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
2	M	1	0	0	0	0
2	N	1	0	0	0	0
2	O	1	0	0	0	0
2	P	1	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
3	M	1	0	0	0	0
3	N	1	0	0	0	0
3	O	1	0	0	0	0
3	P	1	0	0	0	0
4	A	15	0	0	0	0
4	B	12	0	0	0	0
4	C	16	0	0	1	0
4	D	16	0	0	0	0
4	M	15	0	0	0	0
4	N	14	0	0	0	0
4	O	15	0	0	0	0
4	P	18	0	0	0	0
All	All	11100	0	10923	72	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 4.

The worst 5 of 72 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:101:CYS:HG	1:A:126:CYS:HG	0.79	0.71
1:C:101:CYS:HG	1:C:126:CYS:HG	0.75	0.67
1:C:172:SER:OG	1:C:173:GLY:N	2.27	0.67
1:C:173:GLY:O	4:C:2016:HOH:O	2.11	0.67
1:O:172:SER:OG	1:O:173:GLY:N	2.27	0.66

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	167/188 (89%)	165 (99%)	1 (1%)	1 (1%)	22	33
1	B	165/188 (88%)	161 (98%)	4 (2%)	0	100	100
1	C	167/188 (89%)	164 (98%)	3 (2%)	0	100	100
1	D	166/188 (88%)	162 (98%)	4 (2%)	0	100	100
1	M	167/188 (89%)	164 (98%)	1 (1%)	2 (1%)	11	16
1	N	166/188 (88%)	162 (98%)	4 (2%)	0	100	100
1	O	167/188 (89%)	164 (98%)	2 (1%)	1 (1%)	22	33
1	P	166/188 (88%)	162 (98%)	4 (2%)	0	100	100
All	All	1331/1504 (88%)	1304 (98%)	23 (2%)	4 (0%)	37	51

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	172	SER
1	M	7	GLU
1	M	172	SER
1	O	7	GLU

### 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	146/158 (92%)	142 (97%)	4 (3%)	40	60
1	B	144/158 (91%)	141 (98%)	3 (2%)	48	69
1	C	146/158 (92%)	143 (98%)	3 (2%)	48	69
1	D	145/158 (92%)	142 (98%)	3 (2%)	48	69
1	M	146/158 (92%)	142 (97%)	4 (3%)	40	60
1	N	145/158 (92%)	142 (98%)	3 (2%)	48	69
1	O	146/158 (92%)	143 (98%)	3 (2%)	48	69
1	P	145/158 (92%)	142 (98%)	3 (2%)	48	69
All	All	1163/1264 (92%)	1137 (98%)	26 (2%)	47	67

5 of 26 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	M	108	GLU
1	N	64	GLU
1	P	150	GLN
1	M	153	LEU
1	N	150	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 11 such sidechains are listed below:

Mol	Chain	Res	Type
1	N	79	GLN
1	O	79	GLN
1	P	79	GLN
1	O	154	GLN
1	C	154	GLN

### 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 [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 16 ligands modelled in this entry, 16 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 [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, 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	165/188 (87%)	-1.75	0 100 100	18, 27, 32, 46	0
1	B	163/188 (86%)	-1.73	0 100 100	19, 26, 32, 45	0
1	C	165/188 (87%)	-1.75	0 100 100	18, 26, 33, 47	0
1	D	164/188 (87%)	-1.73	0 100 100	19, 26, 33, 44	0
1	M	165/188 (87%)	-1.72	0 100 100	18, 27, 33, 46	0
1	N	164/188 (87%)	-1.76	0 100 100	21, 26, 33, 45	0
1	O	165/188 (87%)	-1.73	0 100 100	19, 26, 33, 47	0
1	P	164/188 (87%)	-1.77	0 100 100	19, 26, 33, 44	0
All	All	1315/1504 (87%)	-1.74	0 100 100	18, 26, 33, 47	0

There are no RSRZ outliers to report.

### 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( $\text{\AA}^2$ )	Q<0.9
2	ZN	A	1175	1/1	1.00	0.01	41,41,41,41	0
2	ZN	B	1175	1/1	1.00	0.01	41,41,41,41	0
2	ZN	C	1175	1/1	1.00	0.01	41,41,41,41	0
2	ZN	D	1175	1/1	1.00	0.01	37,37,37,37	0
2	ZN	M	1175	1/1	1.00	0.01	41,41,41,41	0
2	ZN	N	1175	1/1	1.00	0.01	42,42,42,42	0
2	ZN	O	1175	1/1	1.00	0.01	41,41,41,41	0
2	ZN	P	1175	1/1	1.00	0.00	35,35,35,35	0
3	FE	A	1176	1/1	1.00	0.03	40,40,40,40	0
3	FE	B	1176	1/1	1.00	0.03	41,41,41,41	0
3	FE	C	1176	1/1	1.00	0.02	38,38,38,38	0
3	FE	D	1176	1/1	1.00	0.02	32,32,32,32	0
3	FE	M	1176	1/1	1.00	0.02	39,39,39,39	0
3	FE	N	1176	1/1	1.00	0.03	41,41,41,41	0
3	FE	O	1176	1/1	1.00	0.02	39,39,39,39	0
3	FE	P	1176	1/1	1.00	0.02	34,34,34,34	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.