



# wwPDB X-ray Structure Validation Summary Report

Feb 28, 2014 – 10:13 PM GMT

PDB ID : 2C3P  
Title : CRYSTAL STRUCTURE OF THE FREE RADICAL INTERMEDIATE OF  
PYRUVATE:FERREDOXIN OXIDOREDUCTASE FROM DESULFOVIB-  
RIO AFRICANUS  
Authors : Cavazza, C.; Contreras-Martel, C.; Pieulle, L.; Chabriere, E.; Hatchikian,  
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Deposited on : 2005-10-11  
Resolution : 2.33 Å(reported)

This is a wwPDB 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 <http://wwpdb.org/ValidationPDFNotes.html>

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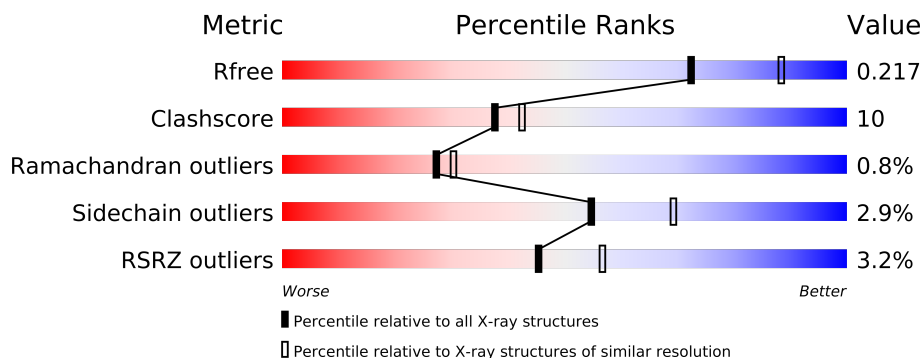
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.15 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 2.33 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	4049 (2.38-2.30)
Clashscore	79885	1094 (2.36-2.32)
Ramachandran outliers	78287	1080 (2.36-2.32)
Sidechain outliers	78261	1081 (2.36-2.32)
RSRZ outliers	66119	4050 (2.38-2.30)

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  $\geq 3$ , 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	1231	
1	B	1231	

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

Mol	Type	Chain	Res	Geometry	Electron density
5	CA	A	2238	-	X

## 2 Entry composition i

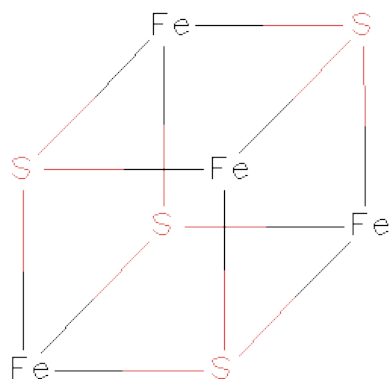
There are 6 unique types of molecules in this entry. The entry contains 19733 atoms, of which 0 are hydrogen and 0 are deuterium.

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 PYRUVATE-FERREDOXIN OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	1231	Total	C	N	O	S	0	0	0
			9383	5941	1599	1784	59			
1	B	1231	Total	C	N	O	S	0	0	0
			9383	5941	1599	1784	59			

- Molecule 2 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe<sub>4</sub>S<sub>4</sub>).



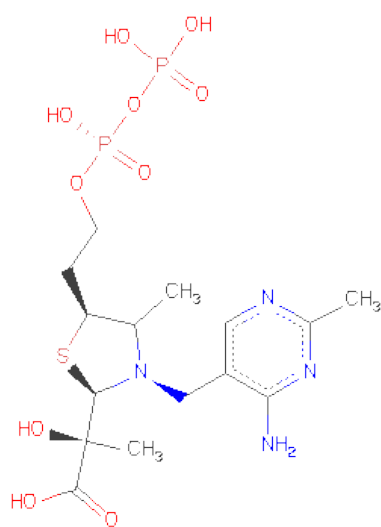
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	Fe	S	0	0
			8	4	4		
2	A	1	Total	Fe	S	0	0
			8	4	4		
2	A	1	Total	Fe	S	0	0
			8	4	4		
2	B	1	Total	Fe	S	0	0
			8	4	4		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	Fe	S	0	0
			8	4	4		
2	B	1	Total	Fe	S	0	0
			8	4	4		

- Molecule 3 is 1-(2-((2S,4R,5R)-3-[(4-AMINO-2-METHYLPYRIMIDIN-5-YL)METHYL]-2-[(1S)-1-CARBOXY-1-HYDROXYETHYL]-4-METHYL-1,3-THIAZOLIDIN-5-YL}ETHOXY)-1,1,3,3-TETRAHYDROXY-1LAMBDA 5 -DIPHOSPHOX-1-EN-2-IUM3-OXIDE (three-letter code: 1TP) (formula: C<sub>15</sub>H<sub>26</sub>N<sub>4</sub>O<sub>10</sub>P<sub>2</sub>S).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	S	0	0
			32	15	4	10	2	1		
3	B	1	Total	C	N	O	P	S	0	0
			32	15	4	10	2	1		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Mg	0	0
			1	1		
4	A	1	Total	Mg	0	0
			1	1		

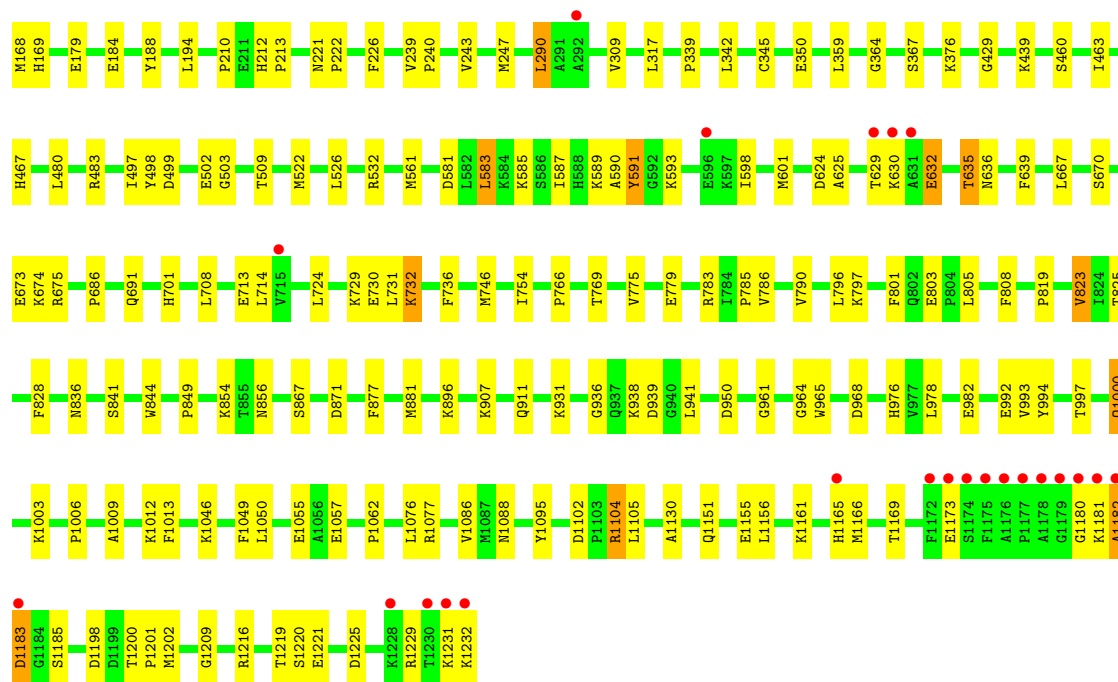
- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	1	Total 1	Ca 1	0	0
5	A	1	Total 1	Ca 1	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	379	Total 379	O 379	0	0
6	B	472	Total 472	O 472	0	0





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	85.97Å 145.84Å 210.82Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.37 – 2.33 47.37 – 2.33	Depositor EDS
% Data completeness (in resolution range)	98.3 (47.37-2.33) 98.4 (47.37-2.33)	Depositor EDS
$R_{merge}$	0.01	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.55 (at 2.34Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.171 , 0.223 0.169 , 0.217	Depositor DCC
$R_{free}$ test set	5637 reflections (5.30%)	DCC
Wilson B-factor (Å <sup>2</sup> )	20.5	Xtriage
Anisotropy	0.182	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 24.1	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.46$ , $\langle L^2 \rangle = 0.29$	Xtriage
Outliers	0 of 111925 reflections	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	19733	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.88% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities 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: MG, CA, SF4, 1TP

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	0.44	0/9585	0.68	2/12954 (0.0%)
1	B	0.46	0/9585	0.69	4/12954 (0.0%)
All	All	0.45	0/19170	0.69	6/25908 (0.0%)

There are no bond length outliers.

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	125	GLY	N-CA-C	6.52	129.41	113.10
1	B	125	GLY	N-CA-C	5.85	127.73	113.10
1	B	1104	ARG	NE-CZ-NH1	-5.67	117.47	120.30
1	B	994	TYR	N-CA-C	-5.34	96.58	111.00
1	A	317	LEU	CA-CB-CG	5.32	127.53	115.30

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	9383	0	9262	232	0
1	B	9383	0	9262	157	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	24	0	0	0	0
2	B	24	0	0	0	0
3	A	32	0	21	7	0
3	B	32	0	21	8	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
6	A	379	0	0	3	0
6	B	472	0	0	6	0
All	All	19733	0	18566	374	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 10.

The worst 5 of 374 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
3:A:2236:1TP:C15	3:A:2236:1TP:C25	1.79	1.59
3:B:2236:1TP:C25	3:B:2236:1TP:C15	1.82	1.56
3:B:2236:1TP:C2	3:B:2236:1TP:N3	1.67	1.48
3:B:2236:1TP:C2	3:B:2236:1TP:C15	1.93	1.44
3:A:2236:1TP:C15	3:A:2236:1TP:C2	2.09	1.29

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	1229/1231 (100%)	1168 (95%)	47 (4%)	14 (1%)	21	20
1	B	1229/1231 (100%)	1183 (96%)	40 (3%)	6 (0%)	38	44
All	All	2458/2462 (100%)	2351 (96%)	87 (4%)	20 (1%)	27	30

5 of 20 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	732	LYS
1	A	593	LYS
1	A	594	LYS
1	A	595	GLY
1	A	629	THR

### 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	978/978 (100%)	942 (96%)	36 (4%)	45	59
1	B	978/978 (100%)	957 (98%)	21 (2%)	66	81
All	All	1956/1956 (100%)	1899 (97%)	57 (3%)	55	69

5 of 57 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	893	LEU
1	A	1147	ARG
1	B	849	PRO
1	A	939	ASP
1	A	1000	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 39 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	866	ASN
1	A	1170	ASN
1	B	1047	GLN
1	A	976	HIS
1	A	1000	GLN

### 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 ⓘ

Of 12 ligands modelled in this entry, 4 are monoatomic - leaving 8 for Mogul analysis.

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	SF4	A	2233	1	12,12,12	4.62	9 (75%)	0,24,24	0.00	-
2	SF4	A	2234	1	12,12,12	5.19	11 (91%)	0,24,24	0.00	-
2	SF4	A	2235	1	12,12,12	6.30	10 (83%)	0,24,24	0.00	-
3	1TP	A	2236	4	33,33,33	6.94	18 (54%)	51,51,51	3.02	18 (35%)
2	SF4	B	2233	1	12,12,12	5.88	9 (75%)	0,24,24	0.00	-
2	SF4	B	2234	1	12,12,12	93.42	12 (100%)	0,24,24	0.00	-
2	SF4	B	2235	1	12,12,12	7.80	11 (91%)	0,24,24	0.00	-
3	1TP	B	2236	4	33,33,33	5.81	19 (57%)	51,51,51	3.72	21 (41%)

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	SF4	A	2233	1	-	0/0/48/48	0/0/5/5
2	SF4	A	2234	1	-	0/0/48/48	0/0/5/5
2	SF4	A	2235	1	-	0/0/48/48	0/0/5/5
3	1TP	A	2236	4	1/1/8/8	0/24/45/45	0/2/2/2
2	SF4	B	2233	1	-	0/0/48/48	0/0/5/5

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	SF4	B	2234	1	-	0/0/48/48	0/0/5/5
2	SF4	B	2235	1	-	0/0/48/48	0/0/5/5
3	1TP	B	2236	4	1/1/8/8	0/24/45/45	0/2/2/2

The worst 5 of 99 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2234	SF4	S3-FE4	230.15	3.88	2.33
2	B	2234	SF4	S4-FE3	226.88	3.85	2.33
3	A	2236	1TP	C15-C2	30.65	2.09	1.56
3	B	2236	1TP	C15-C2	21.62	1.93	1.56
2	B	2235	SF4	S3-FE2	-12.50	2.24	2.33

The worst 5 of 39 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	2236	1TP	C2-S1-C5	-12.21	81.76	94.29
3	A	2236	1TP	C15-C2-N3	11.18	127.15	109.33
3	A	2236	1TP	C4A-C4-C5	9.04	127.09	113.75
3	B	2236	1TP	C15-C2-N3	9.02	123.71	109.33
3	B	2236	1TP	C4A-C4-C5	8.91	126.91	113.75

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	A	2236	1TP	C4
3	B	2236	1TP	C4

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, 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	1231/1231 (100%)	-0.06	55 (4%)	32 43	7, 22, 62, 118	0
1	B	1231/1231 (100%)	-0.24	23 (1%)	64 74	7, 19, 46, 104	0
All	All	2462/2462 (100%)	-0.15	78 (3%)	45 57	7, 20, 57, 118	0

The worst 5 of 78 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1176	ALA	9.5
1	B	631	ALA	8.5
1	B	1232	LYS	6.9
1	A	594	LYS	6.7
1	A	1177	PRO	6.4

### 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, 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	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
5	CA	A	2238	1/1	0.19	4.93	57,57,57,57	0
3	1TP	A	2236	32/32	0.15	0.07	14,20,39,43	0
4	MG	B	2237	1/1	0.12	-0.03	4,4,4,4	0
3	1TP	B	2236	32/32	0.15	-0.10	6,15,32,32	0
5	CA	B	2238	1/1	0.10	-0.42	46,46,46,46	0
2	SF4	B	2235	8/8	0.07	-1.49	10,12,13,13	0
2	SF4	A	2235	8/8	0.06	-1.66	15,18,19,20	0
2	SF4	B	2234	8/8	0.04	-1.94	13,14,15,17	0
4	MG	A	2237	1/1	0.05	-2.52	9,9,9,9	0
2	SF4	B	2233	8/8	0.05	-2.75	19,20,21,23	0
2	SF4	A	2234	8/8	0.04	-2.83	22,25,25,27	0
2	SF4	A	2233	8/8	0.04	-3.17	27,31,32,33	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.