



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 14, 2020 – 02:43 am BST

PDB ID : 1J9K  
Title : CRYSTAL STRUCTURE OF SURE PROTEIN FROM T.MARITIMA IN  
COMPLEX WITH TUNGSTATE  
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Deposited on : 2001-05-27  
Resolution : 2.10 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.

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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	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

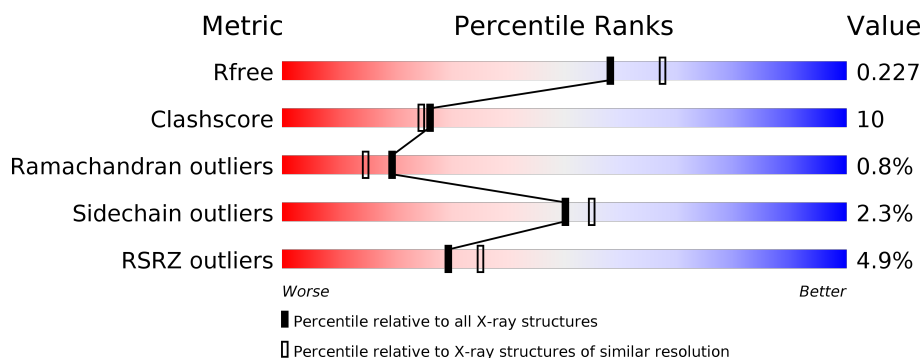
# 1 Overall quality at a glance ⓘ

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))
$R_{free}$	130704	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (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 on 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	247	<div> <div>4%</div> <div> <div></div> <div>76%</div> <div>22%</div> <div>•</div> </div> </div>
1	B	247	<div> <div>5%</div> <div> <div></div> <div>78%</div> <div>20%</div> <div>•</div> </div> </div>

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4277 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.

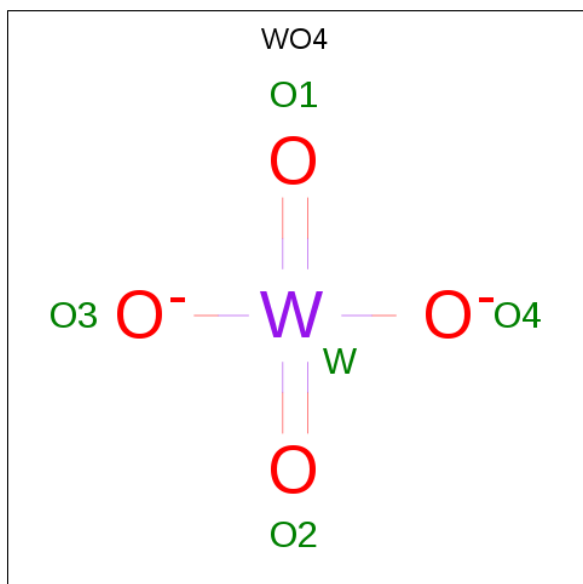
- Molecule 1 is a protein called STATIONARY PHASE SURVIVAL PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	247	Total	C	N	O	S	0	0	0
			1972	1255	331	373	13			
1	B	247	Total	C	N	O	S	0	0	0
			1972	1255	331	373	13			

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 3 is TUNGSTATE(VI)ION (three-letter code: WO4) (formula: O<sub>4</sub>W).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	W	0	0
			5	4	1		
3	B	1	Total	O	W	0	0
			5	4	1		

- Molecule 4 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: C<sub>8</sub>H<sub>18</sub>N<sub>2</sub>O<sub>4</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	S	0	0
			15	8	2	4	1		
4	B	1	Total	C	N	O	S	0	0
			15	8	2	4	1		

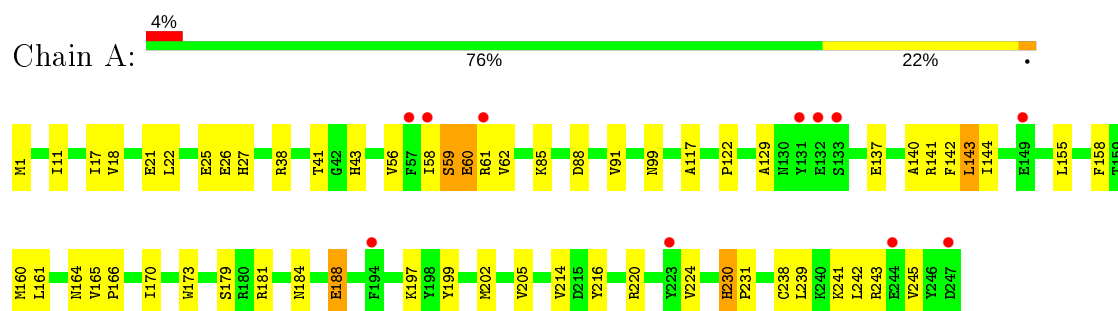
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	134	Total	O	0	0
			134	134		
5	B	157	Total	O	0	0
			157	157		

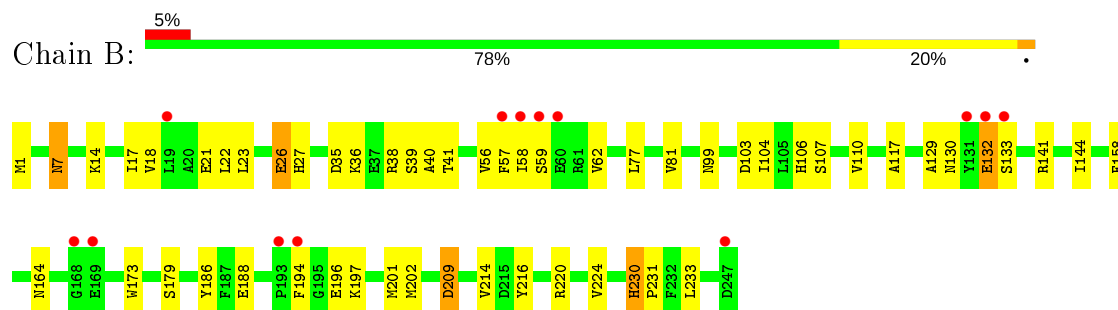
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: STATIONARY PHASE SURVIVAL PROTEIN



#### • Molecule 1: STATIONARY PHASE SURVIVAL PROTEIN



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	114.91Å 114.91Å 78.54Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	19.90 – 2.10 19.90 – 2.10	Depositor EDS
% Data completeness (in resolution range)	97.0 (19.90-2.10) 97.7 (19.90-2.10)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.33 (at 2.09Å)	Xtriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.192 , 0.231 0.189 , 0.227	Depositor DCC
$R_{free}$ test set	3437 reflections (9.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	26.0	Xtriage
Anisotropy	0.045	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 54.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.026 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	4277	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.85% 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: WO4, CA, EPE

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	0.31	0/2016	0.65	1/2729 (0.0%)
1	B	0.60	1/2016 (0.0%)	0.68	3/2729 (0.1%)
All	All	0.48	1/4032 (0.0%)	0.66	4/5458 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	132	GLU	C-N	22.86	1.86	1.34

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	132	GLU	O-C-N	-8.56	109.00	122.70
1	B	132	GLU	C-N-CA	-6.26	106.05	121.70
1	A	184	ASN	N-CA-C	-6.05	94.66	111.00
1	B	132	GLU	CA-C-N	5.56	129.42	117.20

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	1972	0	1937	39	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1972	0	1937	43	1
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	5	0	0	0	0
3	B	5	0	0	0	0
4	A	15	0	18	0	0
4	B	15	0	18	2	0
5	A	134	0	0	3	2
5	B	157	0	0	5	2
All	All	4277	0	3910	82	5

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 10.

The worst 5 of 82 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:B:132:GLU:C	1:B:133:SER:N	1.86	1.28
1:A:99:ASN:H	1:A:164:ASN:HD21	1.11	0.88
1:B:99:ASN:H	1:B:164:ASN:HD21	1.22	0.87
1:B:22:LEU:HB3	1:B:144:ILE:HD11	1.65	0.78
1:B:188:GLU:HB2	1:B:202:MET:HE1	1.66	0.78

All (5) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:A:618:HOH:O	5:A:618:HOH:O[4_555]	1.17	1.03
5:B:1609:HOH:O	5:B:1609:HOH:O[5_555]	1.73	0.47
5:B:1618:HOH:O	5:B:1618:HOH:O[5_555]	1.91	0.29
1:B:233:LEU:CD2	1:B:233:LEU:CD2[5_555]	1.98	0.22
5:A:614:HOH:O	5:A:614:HOH:O[6_555]	2.06	0.14

## 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	245/247 (99%)	233 (95%)	10 (4%)	2 (1%)	19	15
1	B	245/247 (99%)	233 (95%)	10 (4%)	2 (1%)	19	15
All	All	490/494 (99%)	466 (95%)	20 (4%)	4 (1%)	19	15

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	59	SER
1	A	129	ALA
1	B	129	ALA
1	B	26	GLU

### 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	217/217 (100%)	210 (97%)	7 (3%)	39	41
1	B	217/217 (100%)	214 (99%)	3 (1%)	67	73
All	All	434/434 (100%)	424 (98%)	10 (2%)	50	55

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	188	GLU
1	A	230	HIS
1	B	7	ASN
1	A	161	LEU
1	A	239	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	7	ASN
1	B	80	ASN
1	B	106	HIS
1	A	164	ASN
1	B	99	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 carbohydrates in this entry.

### 5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 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	$\# Z  > 2$
3	WO4	A	401	1,2	2,4,4	0.17	0	-		
4	EPE	B	1501	-	15,15,15	1.87	2 (13%)	18,20,20	1.82	4 (22%)
4	EPE	A	501	-	15,15,15	2.02	3 (20%)	18,20,20	1.83	3 (16%)
3	WO4	B	1401	1,2	2,4,4	0.32	0	-		

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
4	EPE	B	1501	-	-	2/9/19/19	0/1/1/1
4	EPE	A	501	-	-	3/9/19/19	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	1501	EPE	O3S-S	5.63	1.67	1.47
4	A	501	EPE	O3S-S	5.62	1.67	1.47
4	A	501	EPE	C10-S	3.50	1.82	1.77
4	B	1501	EPE	C10-S	2.85	1.81	1.77
4	A	501	EPE	C5-N4	2.05	1.52	1.46

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	501	EPE	O2S-S-C10	5.02	112.96	106.92
4	B	1501	EPE	O2S-S-C10	4.83	112.73	106.92
4	A	501	EPE	O3S-S-O1S	-3.62	102.42	111.27
4	B	1501	EPE	O3S-S-O1S	-3.32	103.17	111.27
4	B	1501	EPE	O2S-S-O1S	2.29	121.88	113.95

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	501	EPE	N4-C7-C8-O8
4	A	501	EPE	C10-C9-N1-C2
4	A	501	EPE	C10-C9-N1-C6
4	B	1501	EPE	C10-C9-N1-C2
4	B	1501	EPE	C10-C9-N1-C6

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	1501	EPE	2	0

## 5.7 Other polymers

There are no such residues in this entry.

## 5.8 Polymer linkage issues

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	132:GLU	C	133:SER	N	1.86

## 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	247/247 (100%)	0.06	11 (4%) 33 38	14, 26, 54, 79	0
1	B	247/247 (100%)	0.13	13 (5%) 26 32	13, 25, 52, 83	0
All	All	494/494 (100%)	0.10	24 (4%) 29 35	13, 26, 54, 83	0

The worst 5 of 24 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	247	ASP	4.6
1	B	247	ASP	4.1
1	B	132	GLU	4.0
1	B	168	GLY	3.8
1	A	194	PHE	3.4

### 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 carbohydrates 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
4	EPE	A	501	15/15	0.62	0.34	51,60,66,67	0
4	EPE	B	1501	15/15	0.79	0.18	47,48,58,59	0
2	CA	B	1301	1/1	0.99	0.05	27,27,27,27	0
3	WO4	A	401	5/5	0.99	0.14	35,35,37,37	0
2	CA	A	301	1/1	0.99	0.09	29,29,29,29	0
3	WO4	B	1401	5/5	0.99	0.08	19,23,25,26	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.