



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 1, 2026 – 05:28 PM UTC

PDB ID : 1TKO / pdb\_00001tko  
Title : Iron-oxo clusters biomineralizing on protein surfaces. Structural analysis of H.salinarum DpsA in its low and high iron states  
Authors : Zeth, K.; Offermann, S.; Essen, L.O.; Oesterhelt, D.  
Deposited on : 2004-06-09  
Resolution : 2.90 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 : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

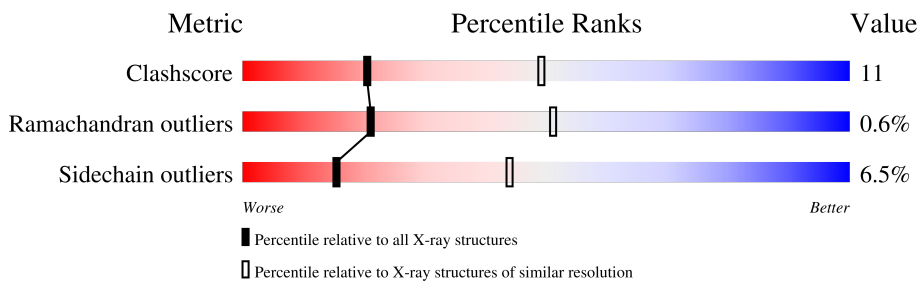
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.90 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))
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)

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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	182	66% (green), 30% (yellow), 4% (orange), 0% (red), 0% (grey)
1	B	182	69% (green), 23% (yellow), 6% (orange), 2% (red), 0% (grey)
1	C	182	70% (green), 23% (yellow), 6% (orange), 1% (red), 0% (grey)
1	D	182	68% (green), 26% (yellow), 6% (orange), 0% (red), 0% (grey)

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	SO4	A	201	-	-	X	-
2	SO4	B	202	-	-	X	-

## 2 Entry composition [i](#)

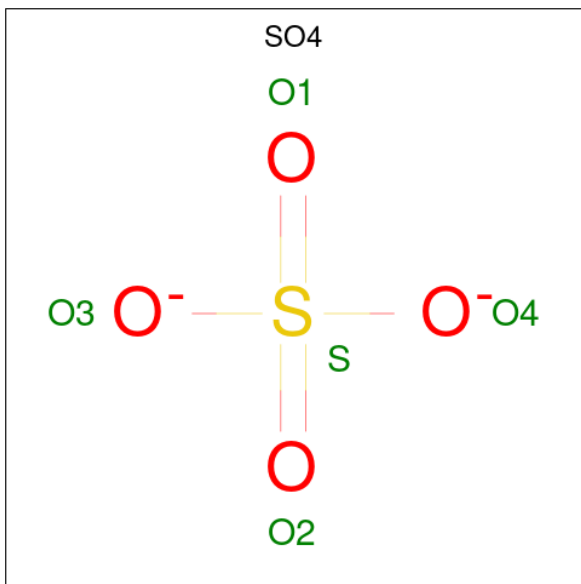
There are 5 unique types of molecules in this entry. The entry contains 5549 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Iron-rich dpsA-homolog protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	180	Total 1394	C 852	N 242	O 296	S 4	0	0	0
1	B	175	Total 1355	C 830	N 234	O 287	S 4	0	0	0
1	C	175	Total 1355	C 830	N 234	O 287	S 4	0	0	0
1	D	175	Total 1355	C 830	N 234	O 287	S 4	0	0	0

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
2	A	1	Total 5	O 4	S 1	0	0
2	B	1	Total 5	O 4	S 1	0	0

- Molecule 3 is FE (III) ION (CCD ID: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	12	Total 12	Fe 12	0	0
3	B	11	Total 11	Fe 11	0	0
3	C	10	Total 10	Fe 10	0	0
3	D	5	Total 5	Fe 5	0	0

- Molecule 4 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	1	Total 1	Na 1	0	0
4	D	1	Total 1	Na 1	0	0

- Molecule 5 is water.

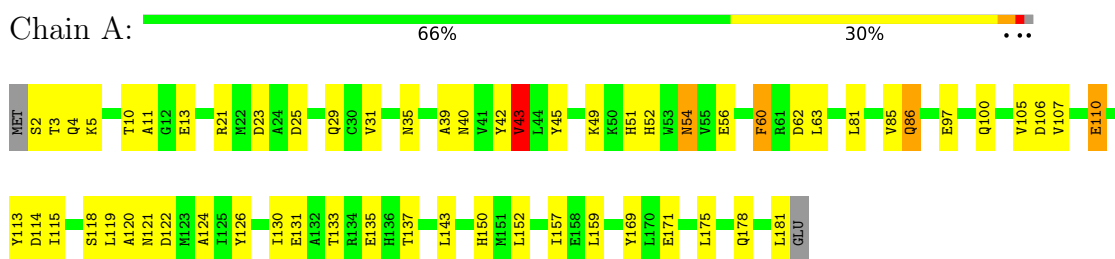
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	13	Total 13	O 13	0	0
5	B	6	Total 6	O 6	0	0
5	C	7	Total 7	O 7	0	0
5	D	14	Total 14	O 14	0	0

### 3 Residue-property plots

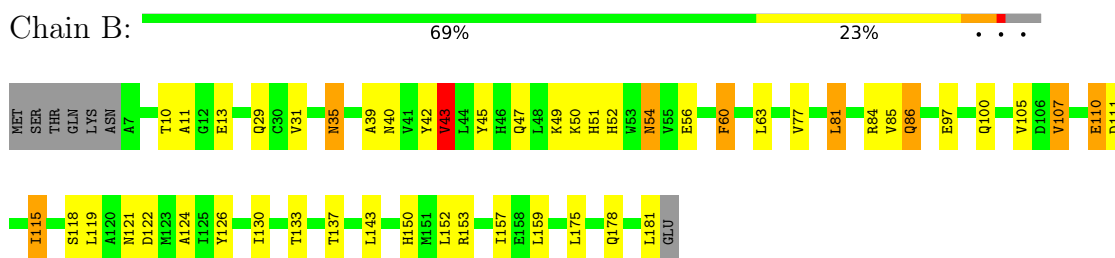
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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. 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.

Note EDS was not executed.

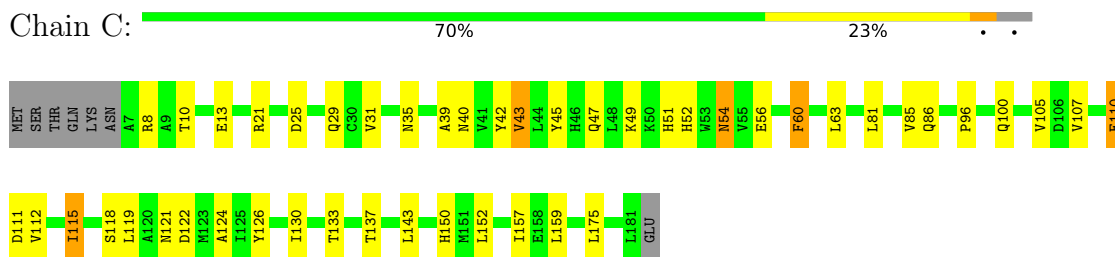
- Molecule 1: Iron-rich dpsA-homolog protein



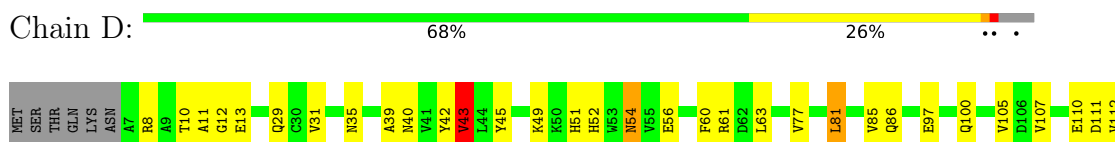
- Molecule 1: Iron-rich dpsA-homolog protein



- Molecule 1: Iron-rich dpsA-homolog protein



- Molecule 1: Iron-rich dpsA-homolog protein





## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 3 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	91.11Å 91.11Å 150.04Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	15.00 – 2.90	Depositor
% Data completeness (in resolution range)	97.7 (15.00-2.90)	Depositor
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	REFMAC 5.1.24	Depositor
R, $R_{free}$	0.178 , 0.263	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	5549	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

## 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: SO4, FE, NA

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	0.47	0/1415	0.86	4/1923 (0.2%)
1	B	0.45	0/1376	0.87	5/1871 (0.3%)
1	C	0.48	0/1376	0.86	5/1871 (0.3%)
1	D	0.49	0/1376	0.87	3/1871 (0.2%)
All	All	0.47	0/5543	0.86	17/7536 (0.2%)

There are no bond length outliers.

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	54	ASN	N-CA-C	6.40	121.28	112.90
1	A	54	ASN	N-CA-C	6.27	121.11	112.90
1	B	43	VAL	N-CA-C	-6.24	103.08	111.44
1	C	54	ASN	N-CA-C	6.05	120.83	112.90
1	D	54	ASN	N-CA-C	5.76	120.44	112.90

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	1394	0	1292	36	29
1	B	1355	0	1253	36	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	1355	0	1253	29	8
1	D	1355	0	1253	33	2
2	A	5	0	0	2	4
2	B	5	0	0	5	0
3	A	12	0	0	0	0
3	B	11	0	0	0	0
3	C	10	0	0	0	0
3	D	5	0	0	0	0
4	C	1	0	0	0	0
4	D	1	0	0	0	0
5	A	13	0	0	3	5
5	B	6	0	0	1	0
5	C	7	0	0	0	0
5	D	14	0	0	2	5
All	All	5549	0	5051	118	37

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 11.

The worst 5 of 118 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:D:13:GLU:HB2	5:D:507:HOH:O	1.79	0.81
1:B:150:HIS:ND1	2:B:202:SO4:O1	2.17	0.71
1:A:135:GLU:HG2	5:A:349:HOH:O	1.95	0.67
1:B:150:HIS:CE1	2:B:202:SO4:O2	2.49	0.66
1:D:133:THR:O	1:D:137:THR:HG23	1.96	0.66

The worst 5 of 37 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)
2:A:201:SO4:S	5:D:502:HOH:O[2_655]	0.96	1.24
2:A:201:SO4:O3	5:D:502:HOH:O[2_655]	1.04	1.16
1:A:3:THR:N	1:A:121:ASN:OD1[3_775]	1.06	1.14
1:A:4:GLN:NE2	1:A:113:TYR:CD1[3_775]	1.29	0.91
1:A:3:THR:CA	1:A:121:ASN:OD1[3_775]	1.37	0.83

## 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	178/182 (98%)	167 (94%)	10 (6%)	1 (1%)	21	51
1	B	173/182 (95%)	164 (95%)	8 (5%)	1 (1%)	21	51
1	C	173/182 (95%)	164 (95%)	8 (5%)	1 (1%)	21	51
1	D	173/182 (95%)	163 (94%)	9 (5%)	1 (1%)	21	51
All	All	697/728 (96%)	658 (94%)	35 (5%)	4 (1%)	21	51

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	110	GLU
1	B	110	GLU
1	C	110	GLU
1	D	110	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	143/145 (99%)	134 (94%)	9 (6%)	16	45
1	B	138/145 (95%)	128 (93%)	10 (7%)	13	39
1	C	138/145 (95%)	130 (94%)	8 (6%)	18	49
1	D	138/145 (95%)	129 (94%)	9 (6%)	15	44
All	All	557/580 (96%)	521 (94%)	36 (6%)	15	44

5 of 36 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	43	VAL
1	D	159	LEU
1	D	60	PHE
1	D	107	VAL
1	B	60	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 26 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	54	ASN
1	C	142	ASN
1	D	150	HIS
1	C	93	HIS
1	C	164	HIS

### 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 42 ligands modelled in this entry, 40 are monoatomic - leaving 2 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	SO4	B	202	-	4,4,4	0.29	0	6,6,6	0.34	0
2	SO4	A	201	-	4,4,4	0.30	0	6,6,6	0.41	0

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.

2 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	202	SO4	5	0
2	A	201	SO4	2	4

## 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

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.