wwPDB X-ray Structure Validation Summary Report (i)

Aug 15, 2023 – 11:38 PM EDT

PDB ID	:	1TKO
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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

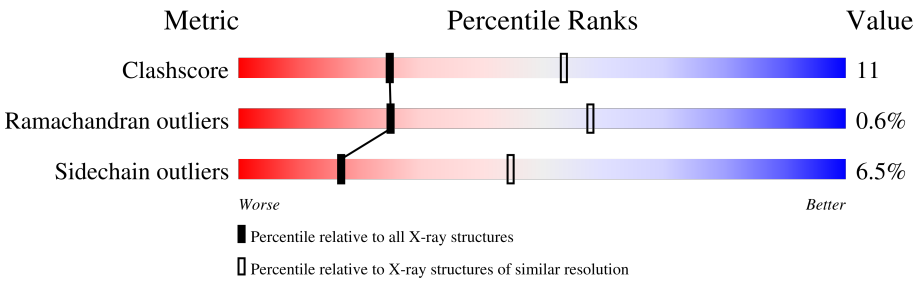
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

1 Overall quality at a glance (i)

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	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (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 >=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 <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	182	67% 31% ••
1	B	182	69% 25% • •
1	C	182	71% 24% • •
1	D	182	69% 26% • •

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)

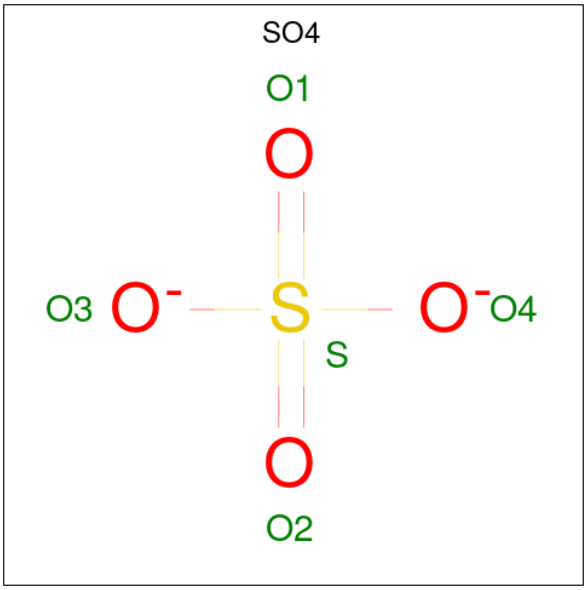
There are 5 unique types of molecules in this entry. The entry contains 5549 atoms, of which 0 are hydrogens and 0 are deuteriums.

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	1394	852	242	296	4	0	0	0
1	B	175	1355	830	234	287	4	0	0	0
1	C	175	1355	830	234	287	4	0	0	0
1	D	175	1355	830	234	287	4	0	0	0

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



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

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

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

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

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

- Molecule 5 is water.

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

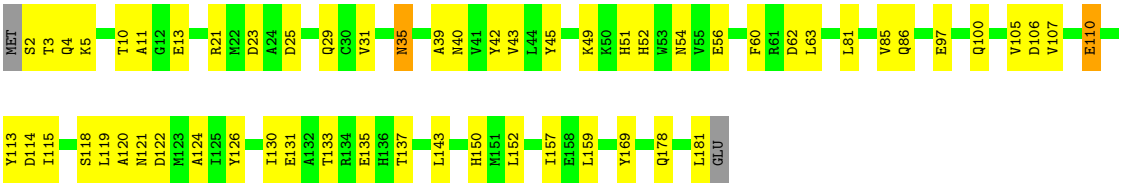
3 Residue-property plots (i)

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. 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.

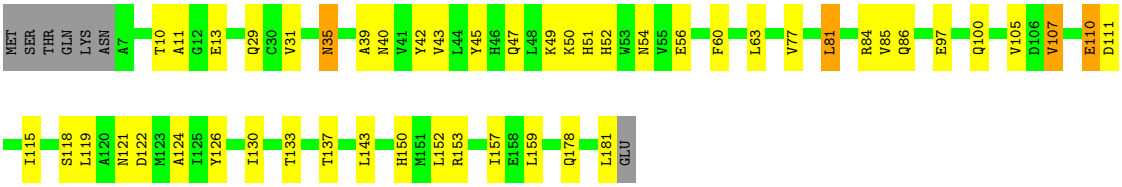
• Molecule 1: Iron-rich dpsA-homolog protein

Chain A:



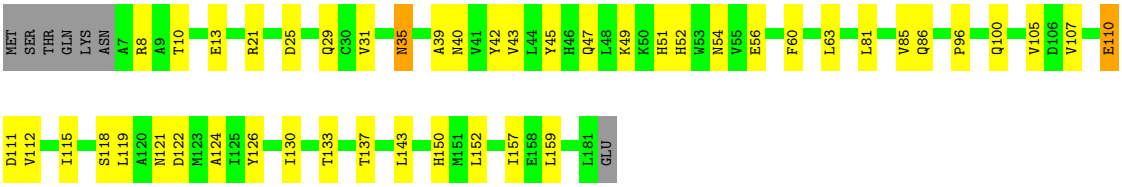
• Molecule 1: Iron-rich dpsA-homolog protein

Chain B:



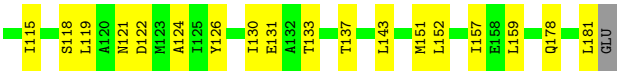
• Molecule 1: Iron-rich dpsA-homolog protein

Chain C:



• Molecule 1: Iron-rich dpsA-homolog protein

Chain D:


I115
S118
L119
A120
N121
D122
M123
A124
I125
Y126
I130
E131
A132
T133
T137
L143
M151
L152
I157
E158
L159
Q178
L181
GLU

4 Data and refinement statistics (i)

Xtriage (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, α, β, γ	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.	Xtriage
Total number of atoms	5549	wwPDB-VP
Average B, all atoms (Å^2)	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: NA, FE, SO4

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	0.37	0/1415	0.53	0/1923
1	B	0.37	0/1376	0.54	0/1871
1	C	0.37	0/1376	0.53	0/1871
1	D	0.37	0/1376	0.54	0/1871
All	All	0.37	0/5543	0.53	0/7536

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	1394	0	1292	33	29
1	B	1355	0	1253	35	0
1	C	1355	0	1253	29	8
1	D	1355	0	1253	32	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

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
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	114	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 114 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:D:151:MET:HE1	5:D:512:HOH:O	1.91	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

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%)	25	58
1	B	173/182 (95%)	164 (95%)	8 (5%)	1 (1%)	25	58
1	C	173/182 (95%)	164 (95%)	8 (5%)	1 (1%)	25	58
1	D	173/182 (95%)	163 (94%)	9 (5%)	1 (1%)	25	58
All	All	697/728 (96%)	658 (94%)	35 (5%)	4 (1%)	25	58

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%)	18	46
1	B	138/145 (95%)	129 (94%)	9 (6%)	17	45
1	C	138/145 (95%)	129 (94%)	9 (6%)	17	45
1	D	138/145 (95%)	129 (94%)	9 (6%)	17	45
All	All	557/580 (96%)	521 (94%)	36 (6%)	17	45

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

Mol	Chain	Res	Type
1	D	42	TYR
1	D	159	LEU
1	D	60	PHE
1	D	107	VAL
1	B	81	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	86	GLN
1	D	142	ASN
1	B	142	ASN
1	B	168	HIS
1	C	29	GLN

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 monosaccharides 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	A	201	-	4,4,4	0.23	0	6,6,6	0.40	0
2	SO4	B	202	-	4,4,4	0.18	0	6,6,6	0.34	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	A	201	SO4	2	4
2	B	202	SO4	5	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)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.