



# wwPDB X-ray Structure Validation Summary Report i

Mar 1, 2014 – 12:18 AM GMT

PDB ID : 1WUH  
Title : Three-Dimensional Structure Of The Ni-A State Of [Nife]Hydrogenase From Desulfovibrio Vulgaris Miyazaki F  
Authors : Ogata, H.; Hirota, S.; Nakahara, A.; Komori, H.; Shibata, N.; Kato, T.; Kano, K.; Higuchi, Y.  
Deposited on : 2004-12-07  
Resolution : 1.24 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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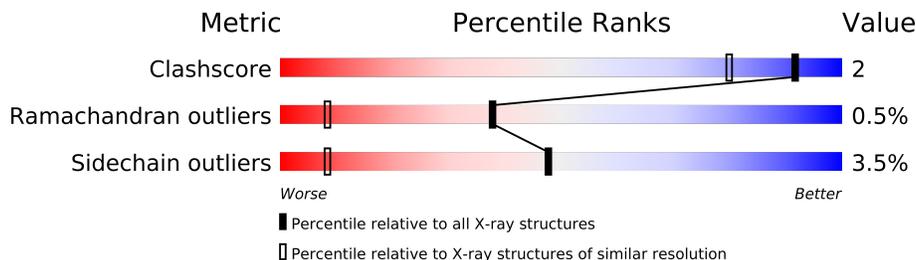
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 21963  
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 1.24 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	79885	1600 (1.30-1.18)
Ramachandran outliers	78287	1524 (1.30-1.18)
Sidechain outliers	78261	1522 (1.30-1.18)

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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	S	267	
2	L	534	

## 2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 7108 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 Periplasmic [NiFe] hydrogenase small subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	S	267	2025	1285	342	380	18	0	3	0

- Molecule 2 is a protein called Periplasmic [NiFe] hydrogenase large subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	L	534	4179	2674	725	765	15	0	0	0

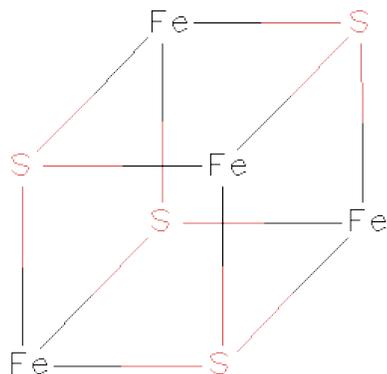
There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
L	84	CSO	CYS	MODIFIED RESIDUE	UNP P21852
L	514	LYS	ASN	SEE REMARK 999	UNP P21852
L	515	LEU	VAL	SEE REMARK 999	UNP P21852
L	546	CSO	CYS	MODIFIED RESIDUE	UNP P21852

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

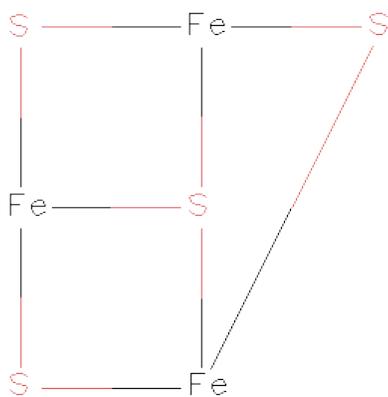
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	L	1	Total	Mg	0	0
			1	1		

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



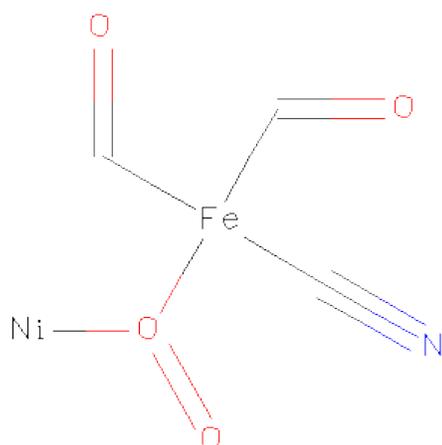
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	S	1	Total	Fe	S	0	0
			8	4	4		
4	S	1	Total	Fe	S	0	0
			8	4	4		

- Molecule 5 is FE3-S4 CLUSTER (three-letter code: F3S) (formula:  $\text{Fe}_3\text{S}_4$ ).



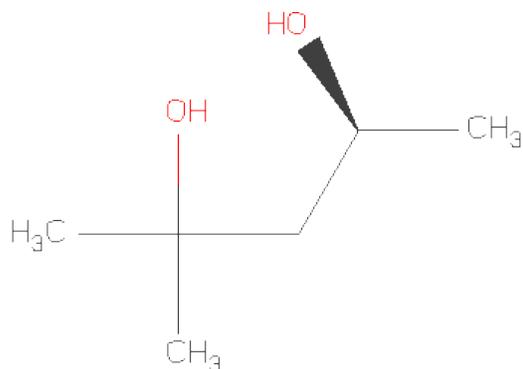
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	S	1	Total	Fe	S	0	0
			7	3	4		

- Molecule 6 is NI-FE ACTIVE CENTER A-FORM (three-letter code: NFC) (formula:  $\text{C}_3\text{H}_2\text{FeNNiO}_4$ ).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	Fe	N	Ni	O		
6	L	1	10	3	1	1	1	4	0	0

- Molecule 7 is (4S)-2-METHYL-2,4-PENTANEDIOL (three-letter code: MPD) (formula: C<sub>6</sub>H<sub>14</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
7	S	1	8	6	2	0	0
7	S	1	8	6	2	0	0

- Molecule 8 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
8	L	547	Total 547	O 547	0	0
8	S	307	Total 307	O 307	0	0

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

Note EDS was not executed.

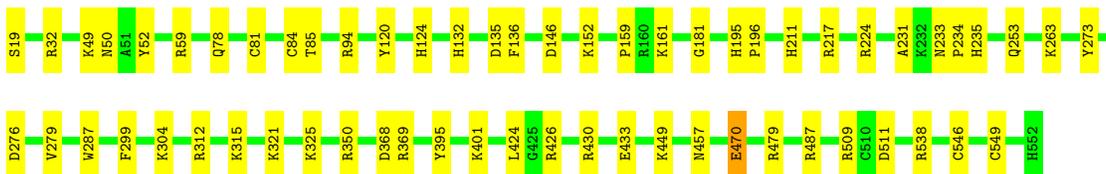
- Molecule 1: Periplasmic [NiFe] hydrogenase small subunit

Chain S: 



- Molecule 2: Periplasmic [NiFe] hydrogenase large subunit

Chain L: 



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	98.23Å 126.26Å 66.44Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	16.41 – 1.24	Depositor
% Data completeness (in resolution range)	(Not available) (16.41-1.24)	Depositor
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	SHELXL-97	Depositor
R, $R_{free}$	0.110 , 0.157	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	7108	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	17.0	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: CSO, NFC, MG, SF4, MPD, F3S

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	S	0.67	0/2099	1.40	22/2862 (0.8%)
2	L	0.69	0/4274	1.34	49/5809 (0.8%)
All	All	0.68	0/6373	1.36	71/8671 (0.8%)

There are no bond length outliers.

The worst 5 of 71 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	L	224	ARG	NE-CZ-NH2	26.20	133.40	120.30
1	S	26	ARG	NE-CZ-NH2	20.60	130.60	120.30
1	S	198	ASP	CB-CG-OD2	-16.45	103.49	118.30
1	S	2	MET	C-N-CA	14.07	151.84	122.30
1	S	198	ASP	CB-CG-OD1	12.91	129.92	118.30

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 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	S	2025	0	0	5	0
2	L	4179	0	0	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	L	1	0	0	0	0
4	S	16	0	0	0	0
5	S	7	0	0	0	0
6	L	10	0	0	0	0
7	S	16	0	0	0	0
8	L	547	0	0	4	0
8	S	307	0	0	2	0
All	All	7108	0	0	12	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 2.

The worst 5 of 12 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:L:546:CSO:OD	2:L:549:CYS:CB	2.25	0.83
2:L:81:CYS:CB	2:L:84:CSO:OD	2.32	0.75
1:S:198:ASP:OD2	8:S:5600:HOH:O	2.13	0.65
2:L:546:CSO:OD	2:L:549:CYS:N	2.40	0.55
1:S:91:ASN:ND2	8:L:5732:HOH:O	2.48	0.46

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	S	268/267 (100%)	260 (97%)	6 (2%)	2 (1%)	30 4
2	L	530/534 (99%)	519 (98%)	9 (2%)	2 (0%)	43 12
All	All	798/801 (100%)	779 (98%)	15 (2%)	4 (0%)	38 8

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	S	5	ARG

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Mol	Chain	Res	Type
1	S	4	PRO
2	L	231	ALA
2	L	235	HIS

### 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	S	216/213 (101%)	207 (96%)	9 (4%)	40 5
2	L	436/436 (100%)	422 (97%)	14 (3%)	51 10
All	All	652/649 (100%)	629 (96%)	23 (4%)	48 8

5 of 23 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	L	49	LYS
2	L	132	HIS
2	L	457	ASN
2	L	50	ASN
2	L	152	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA [i](#)

There are no RNA chains in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

2 non-standard protein/DNA/RNA residues are modelled in this entry.

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	CSO	L	546	2,6	6,6,7	7.69	2 (33%)	3,6,8	4.67	2 (66%)
2	CSO	L	84	2,6	6,6,7	6.38	3 (50%)	3,6,8	2.96	2 (66%)

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	CSO	L	546	2,6	-	0/2/5/7	0/0/0/0
2	CSO	L	84	2,6	-	0/2/5/7	0/0/0/0

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	L	546	CSO	O-C	18.19	1.23	1.11
2	L	84	CSO	O-C	15.14	1.21	1.11
2	L	546	CSO	OD-SG	4.26	1.80	1.62
2	L	84	CSO	OD-SG	2.76	1.74	1.62
2	L	84	CSO	CA-C	2.39	1.52	1.48

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	L	546	CSO	C-CA-N	-6.85	106.99	113.83
2	L	84	CSO	C-CA-N	-4.47	109.36	113.83
2	L	546	CSO	CA-CB-SG	-4.07	105.77	113.01
2	L	84	CSO	CA-CB-SG	2.50	117.46	113.01

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry (i)

Of 7 ligands modelled in this entry, 1 is monoatomic - leaving 6 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
6	NFC	L	1004	2	4,9,9	1.53	0	0,12,12	0.00	-
4	SF4	S	1001	1	12,12,12	132.34	12 (100%)	0,24,24	0.00	-
4	SF4	S	1002	1	12,12,12	132.78	9 (75%)	0,24,24	0.00	-
5	F3S	S	1003	1	3,9,9	6.95	3 (100%)	0,15,15	0.00	-
7	MPD	S	2001	-	7,7,7	0.69	0	10,10,10	2.93	4 (40%)
7	MPD	S	2002	-	7,7,7	0.53	0	10,10,10	1.76	1 (10%)

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
6	NFC	L	1004	2	-	0/0/15/15	0/0/0/0
4	SF4	S	1001	1	-	0/0/48/48	0/0/5/5
4	SF4	S	1002	1	-	0/0/48/48	0/0/5/5
5	F3S	S	1003	1	-	0/0/24/24	0/0/3/3
7	MPD	S	2001	-	-	0/5/5/5	0/0/0/0
7	MPD	S	2002	-	-	0/5/5/5	0/0/0/0

The worst 5 of 24 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	S	1001	SF4	S2-FE4	235.75	3.91	2.33
4	S	1002	SF4	S2-FE4	234.60	3.91	2.33
4	S	1002	SF4	S3-FE2	232.49	3.89	2.33
4	S	1001	SF4	S1-FE3	227.84	3.86	2.33
4	S	1002	SF4	S1-FE3	226.67	3.85	2.33

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
7	S	2001	MPD	O2-C2-C1	-6.73	82.54	107.98
7	S	2002	MPD	CM-C2-C1	4.92	121.02	110.11
7	S	2001	MPD	CM-C2-C1	4.30	119.64	110.11
7	S	2001	MPD	C5-C4-C3	2.48	124.30	111.83
7	S	2001	MPD	O2-C2-C3	2.03	116.27	109.16

There are no chirality outliers.

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

EDS was not executed - this section will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers

EDS was not executed - this section will therefore be empty.