



# wwPDB X-ray Structure Validation Summary Report

Mar 1, 2014 – 12:15 AM GMT

PDB ID : 1WU7  
Title : Crystal structure of histidyl-tRNA synthetase from *Thermoplasma acidophilum*  
Authors : Tanaka, Y.; Sakai, N.; Yao, M.; Watanabe, N.; Tamura, T.; Tanaka, I.  
Deposited on : 2004-12-01  
Resolution : 2.40 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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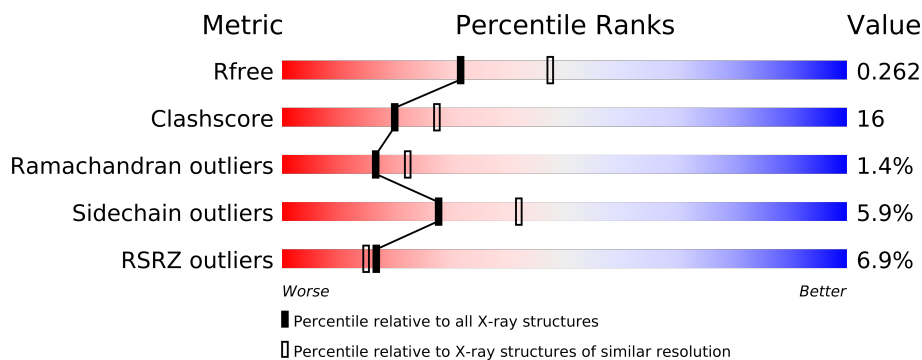
The following versions of software and data (see [references](#)) were used in the production of this report:

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 2.40 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	2207 (2.40-2.40)
Clashscore	79885	2789 (2.40-2.40)
Ramachandran outliers	78287	2736 (2.40-2.40)
Sidechain outliers	78261	2737 (2.40-2.40)
RSRZ outliers	66119	2210 (2.40-2.40)

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	434	
1	B	434	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 6955 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 Histidyl-tRNA synthetase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	424	Total	C	N	O	S	Se	0	0	0
			3371	2123	586	647	2	13			
1	B	420	Total	C	N	O	S	Se	0	0	0
			3340	2104	579	642	2	13			

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	20	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	89	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	168	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	175	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	214	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	228	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	242	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	300	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	312	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	348	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	360	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	367	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	404	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
A	427	LEU	-	EXPRESSION TAG	UNP Q9HLX5
A	428	GLU	-	EXPRESSION TAG	UNP Q9HLX5
A	429	HIS	-	EXPRESSION TAG	UNP Q9HLX5
A	430	HIS	-	EXPRESSION TAG	UNP Q9HLX5
A	431	HIS	-	EXPRESSION TAG	UNP Q9HLX5
A	432	HIS	-	EXPRESSION TAG	UNP Q9HLX5
A	433	HIS	-	EXPRESSION TAG	UNP Q9HLX5
A	434	HIS	-	EXPRESSION TAG	UNP Q9HLX5
B	1	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	20	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	89	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5

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Chain	Residue	Modelled	Actual	Comment	Reference
B	168	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	175	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	214	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	228	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	242	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	300	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	312	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	348	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	360	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	367	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	404	MSE	MET	MODIFIED RESIDUE	UNP Q9HLX5
B	427	LEU	-	EXPRESSION TAG	UNP Q9HLX5
B	428	GLU	-	EXPRESSION TAG	UNP Q9HLX5
B	429	HIS	-	EXPRESSION TAG	UNP Q9HLX5
B	430	HIS	-	EXPRESSION TAG	UNP Q9HLX5
B	431	HIS	-	EXPRESSION TAG	UNP Q9HLX5
B	432	HIS	-	EXPRESSION TAG	UNP Q9HLX5
B	433	HIS	-	EXPRESSION TAG	UNP Q9HLX5
B	434	HIS	-	EXPRESSION TAG	UNP Q9HLX5

- Molecule 2 is water.

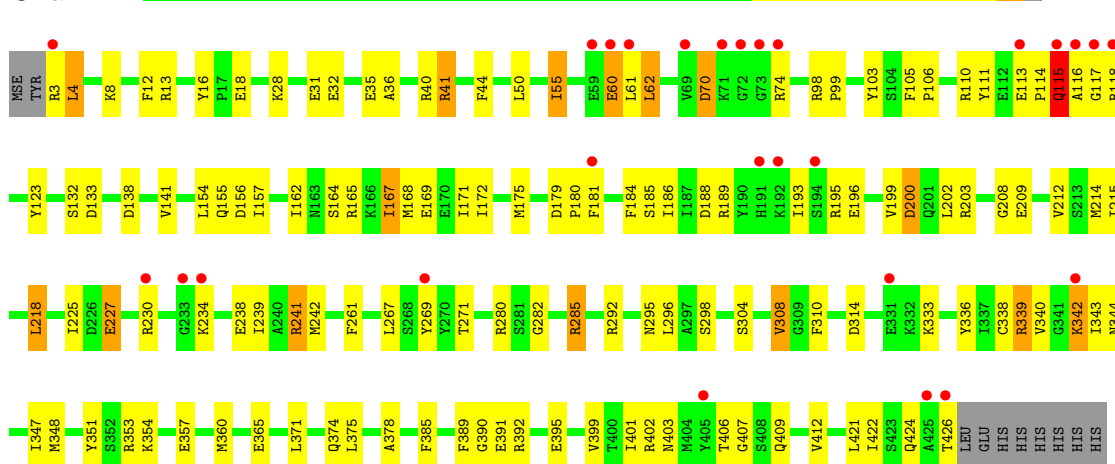
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	111	Total O 111 111	0	0
2	B	133	Total O 133 133	0	0

### 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.

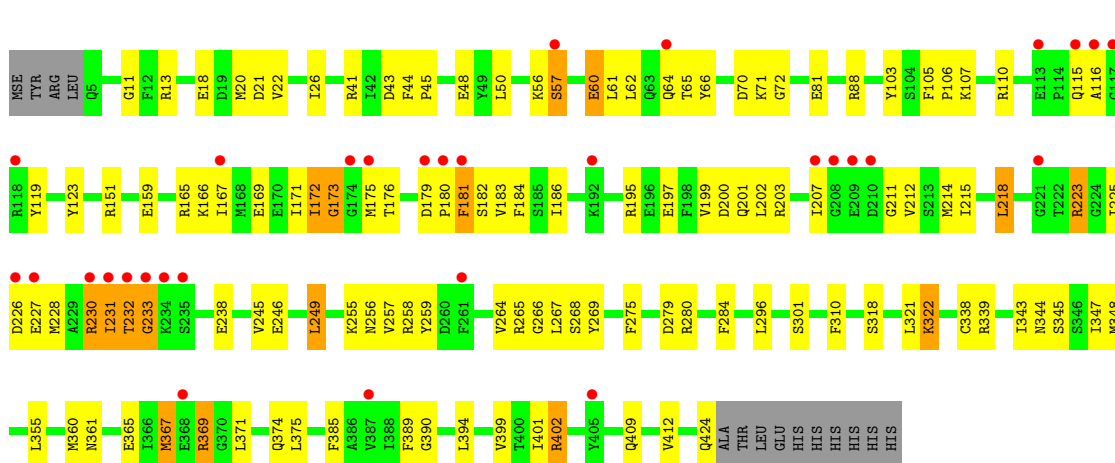
#### • Molecule 1: Histidyl-tRNA synthetase

Chain A:



#### • Molecule 1: Histidyl-tRNA synthetase

Chain B:



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	60.70Å 101.73Å 167.23Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 2.40 19.89 – 2.40	Depositor EDS
% Data completeness (in resolution range)	99.9 (10.00-2.40) 100.0 (19.89-2.40)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	15.29 (at 2.41Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.210 , 0.263 0.210 , 0.262	Depositor DCC
$R_{free}$ test set	4050 reflections (9.95%)	DCC
Wilson B-factor (Å <sup>2</sup> )	38.3	Xtriage
Anisotropy	0.295	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 36.5	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	2 of 41262 reflections (0.005%)	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	6955	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.79% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

## 5 Model quality i

### 5.1 Standard geometry i

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	0.34	0/3415	0.59	0/4572
1	B	0.34	0/3384	0.59	0/4530
All	All	0.34	0/6799	0.59	0/9102

There are no bond length outliers.

There are no bond angle outliers.

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	A	3371	0	3340	112	0
1	B	3340	0	3304	114	0
2	A	111	0	0	5	0
2	B	133	0	0	3	0
All	All	6955	0	6644	213	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 16.

The worst 5 of 213 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:175:MSE:HE1	1:A:215:ILE:HD11	1.35	1.07

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:285:ARG:HH11	1:A:285:ARG:HB2	1.23	0.99
1:B:202:LEU:HG	1:B:207:ILE:HD12	1.52	0.88
1:A:4:LEU:HD12	1:A:4:LEU:H	1.39	0.86
1:B:197:GLU:HG2	1:B:201:GLN:HE21	1.43	0.83

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	422/434 (97%)	403 (96%)	15 (4%)	4 (1%)	25	35
1	B	418/434 (96%)	390 (93%)	20 (5%)	8 (2%)	12	14
All	All	840/868 (97%)	793 (94%)	35 (4%)	12 (1%)	16	22

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	117	GLY
1	B	181	PHE
1	B	233	GLY
1	A	114	PRO
1	A	115	GLN

### 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	360/356 (101%)	337 (94%)	23 (6%)	25	37

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	357/356 (100%)	338 (95%)	19 (5%)	32	48
All	All	717/712 (101%)	675 (94%)	42 (6%)	28	42

5 of 42 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	314	ASP
1	B	44	PHE
1	B	369	ARG
1	A	339	ARG
1	A	399	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	424	GLN
1	B	63	GLN
1	B	295	ASN
1	A	374	GLN
1	B	201	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 ⓘ

There are no ligands in this entry.

## 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	424/434 (97%)	0.19	27 (6%) 19 17	19, 40, 73, 90	0
1	B	420/434 (96%)	0.22	31 (7%) 14 13	16, 40, 86, 101	0
All	All	844/868 (97%)	0.20	58 (6%) 17 15	16, 40, 79, 101	0

The worst 5 of 58 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	405	TYR	6.9
1	B	175	MSE	6.8
1	A	405	TYR	5.9
1	A	115	GLN	5.6
1	B	235	SER	5.4

### 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 ⓘ

There are no ligands in this entry.

### 6.5 Other polymers ⓘ

There are no such residues in this entry.