



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 27, 2024 – 12:07 PM JST

PDB ID : 8J7Q  
Title : The active site mutant of human inorganic pyrophosphatase  
Authors : Hu, F.; Zheng, S.  
Deposited on : 2023-04-28  
Resolution : 1.69 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
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) : 2.36

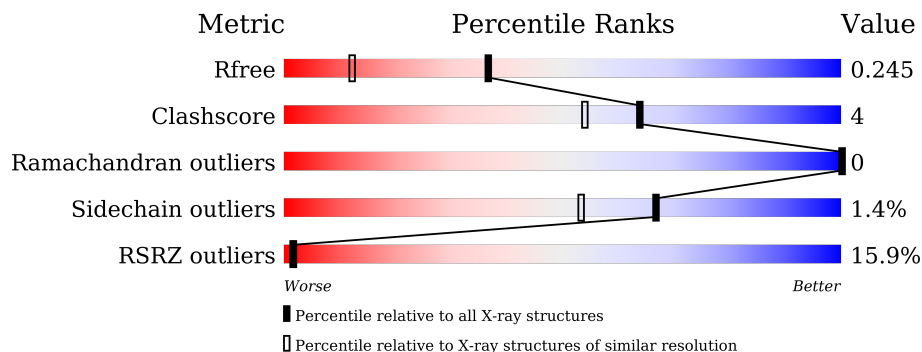
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.69 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	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (1.70-1.70)

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  $\leq 5\%$ . 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	289	

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 2249 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 Inorganic pyrophosphatase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	258	2053	1322	345	376	10	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	116	ALA	ASP	engineered mutation	UNP Q15181
A	118	ALA	ASP	engineered mutation	UNP Q15181
A	119	ALA	PRO	engineered mutation	UNP Q15181
A	121	ALA	ASP	engineered mutation	UNP Q15181

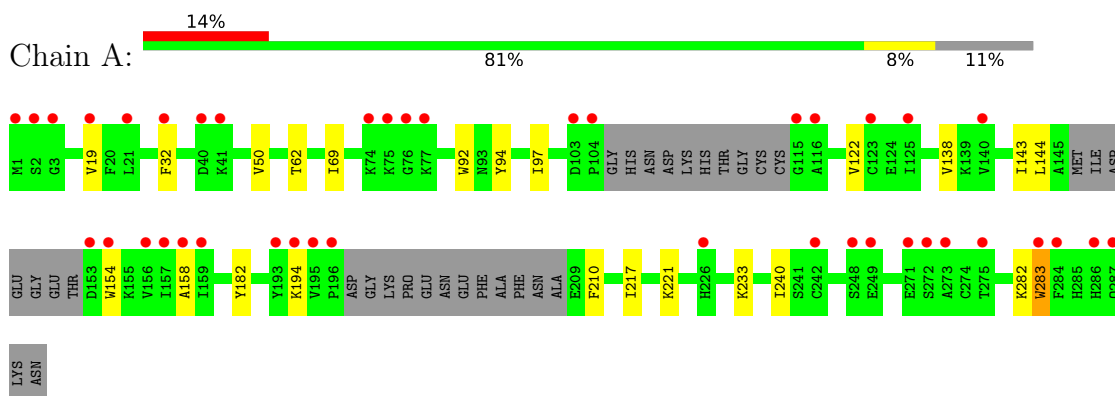
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	196	Total	O	0	0
			196	196		

### 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 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: Inorganic pyrophosphatase



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	83.35Å 90.77Å 95.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.08 – 1.69 19.50 – 1.69	Depositor EDS
% Data completeness (in resolution range)	95.4 (19.08-1.69) 95.5 (19.50-1.69)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.67 (at 1.69Å)	Xtrriage
Refinement program	PHENIX (1.20.1_4487: ???)	Depositor
R, $R_{free}$	0.215 , 0.246 0.218 , 0.245	Depositor DCC
$R_{free}$ test set	1979 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	40.3	Xtrriage
Anisotropy	0.211	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 52.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	2249	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	44.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.04% 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](#)

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	0.44	0/2108	0.62	2/2861 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	283	TRP	CA-CB-CG	6.61	126.26	113.70
1	A	283	TRP	CB-CA-C	-5.50	99.40	110.40

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	2053	0	2027	17	0
2	A	196	0	0	4	0
All	All	2249	0	2027	17	0

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 4.

All (17) 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:A:283:TRP:CD1	2:A:344:HOH:O	2.40	0.75
1:A:283:TRP:HD1	2:A:344:HOH:O	1.75	0.69
1:A:233:LYS:NZ	2:A:302:HOH:O	2.25	0.68
1:A:50:VAL:CG2	1:A:94:TYR:HB3	2.32	0.60
1:A:97:ILE:HG13	1:A:122:VAL:CG2	2.38	0.54
1:A:50:VAL:HG22	1:A:94:TYR:HB3	1.92	0.52
1:A:194:LYS:HB2	2:A:311:HOH:O	2.12	0.50
1:A:143:ILE:HD11	1:A:154:TRP:HB3	1.94	0.49
1:A:217:ILE:HG22	1:A:221:LYS:HD2	1.95	0.48
1:A:62:THR:HB	1:A:240:ILE:HD12	1.99	0.45
1:A:19:VAL:HB	1:A:69:ILE:HB	1.99	0.45
1:A:138:VAL:HB	1:A:158:ALA:HB1	2.00	0.43
1:A:233:LYS:O	1:A:233:LYS:HG3	2.20	0.42
1:A:144:LEU:HB2	1:A:210:PHE:CE1	2.55	0.42
1:A:282:LYS:HE3	1:A:282:LYS:HB3	1.72	0.42
1:A:233:LYS:O	1:A:233:LYS:CG	2.68	0.41
1:A:97:ILE:HG13	1:A:122:VAL:HG21	2.02	0.41

There are no symmetry-related clashes.

## 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	250/289 (86%)	246 (98%)	4 (2%)	0	<b>100</b> <b>100</b>

There are no Ramachandran outliers to report.

### 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	221/246 (90%)	218 (99%)	3 (1%)	67 53

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	32	PHE
1	A	92	TRP
1	A	182	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	226	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 5.7 Other polymers [i](#)

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	258/289 (89%)	0.74	41 (15%) <b>1</b> <b>2</b>	33, 43, 62, 84	0

All (41) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1	MET	8.3
1	A	115	GLY	5.4
1	A	196	PRO	4.6
1	A	116	ALA	4.6
1	A	195	VAL	4.2
1	A	194	LYS	4.2
1	A	3	GLY	4.0
1	A	283	TRP	3.9
1	A	153	ASP	3.9
1	A	271	GLU	3.8
1	A	193	TYR	3.8
1	A	272	SER	3.8
1	A	2	SER	3.6
1	A	104	PRO	3.5
1	A	275	THR	3.4
1	A	248	SER	3.4
1	A	286	HIS	3.2
1	A	103	ASP	3.2
1	A	125	ILE	3.2
1	A	249	GLU	3.1
1	A	156	VAL	3.1
1	A	287	GLN	3.0
1	A	158	ALA	2.8
1	A	75	LYS	2.7
1	A	157	ILE	2.7
1	A	21	LEU	2.7
1	A	40	ASP	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	273	ALA	2.6
1	A	284	PHE	2.5
1	A	154	TRP	2.4
1	A	123	CYS	2.4
1	A	77	LYS	2.3
1	A	19	VAL	2.2
1	A	226	HIS	2.2
1	A	32	PHE	2.2
1	A	41	LYS	2.2
1	A	242	CYS	2.1
1	A	76	GLY	2.1
1	A	74	LYS	2.1
1	A	140	VAL	2.1
1	A	159	ILE	2.0

## 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 monosaccharides in this entry.

## 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.