



# Full wwPDB X-ray Structure Validation Report ⓘ

May 13, 2020 – 12:08 am BST

PDB ID : 4LF0  
Title : The E142D mutant of the amidase from *Geobacillus pallidus*  
Authors : Sewell, B.T.; Weber, B.W.; Kimani, S.W.; Cowan, D.A.; Hunter, R.; Venter, G.A.; Gumbart, J.C.; Thuku, R.N.; Varsani, A.  
Deposited on : 2013-06-26  
Resolution : 1.10 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.

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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	:	2.11
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)	:	2.11

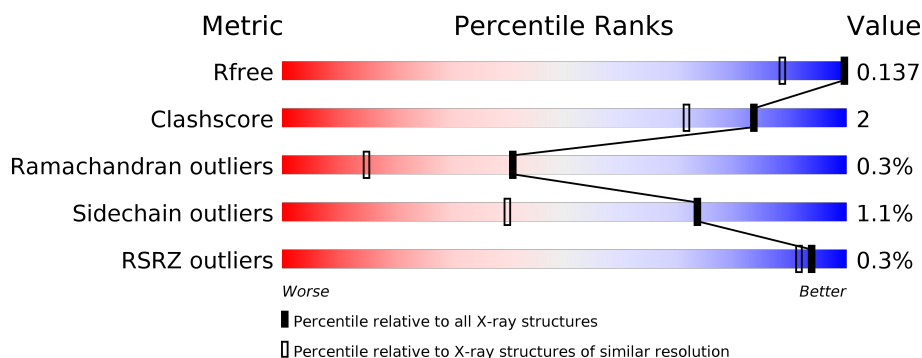
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*


The reported resolution of this entry is 1.10 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	1619 (1.14-1.06)
Clashscore	141614	1671 (1.14-1.06)
Ramachandran outliers	138981	1615 (1.14-1.06)
Sidechain outliers	138945	1613 (1.14-1.06)
RSRZ outliers	127900	1588 (1.14-1.06)

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 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	348	 86% 9% . .

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3129 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 Aliphatic amidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	340	Total	C	N	O	S	0	18	0
			2744	1746	459	517	22			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	142	ASP	GLU	ENGINEERED MUTATION	UNP Q9L543


- Molecule 2 is water.

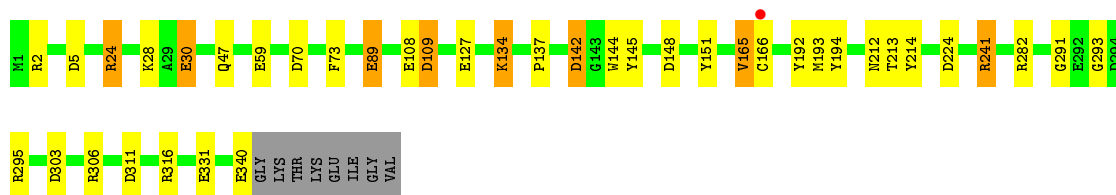
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	385	Total	O	0	0
			385	385		

### 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 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: Aliphatic amidase

Chain A:  86% 9% . .



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 4 <sub>2</sub> 3 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	130.63 Å   130.63 Å   130.63 Å 90.00°   90.00°   90.00°	Depositor
Resolution (Å)	53.33 – 1.10 53.33 – 1.10	Depositor EDS
% Data completeness (in resolution range)	99.8 (53.33-1.10) 99.7 (53.33-1.10)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	7.47 (at 1.10 Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.131   ,   0.137 0.130   ,   0.137	Depositor DCC
$R_{free}$ test set	7607 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	5.6	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.39 , 45.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	3129	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	7.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.99% 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

### 5.1 Standard geometry

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	1.28	15/2861 (0.5%)	1.25	33/3867 (0.9%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	4

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	291	GLY	CA-C	-8.87	1.37	1.51
1	A	24[A]	ARG	CD-NE	7.57	1.59	1.46
1	A	24[B]	ARG	CD-NE	7.57	1.59	1.46
1	A	331	GLU	CD-OE1	6.87	1.33	1.25
1	A	291	GLY	C-O	6.53	1.34	1.23
1	A	127	GLU	CD-OE2	-6.36	1.18	1.25
1	A	151	TYR	CE1-CZ	-6.27	1.30	1.38
1	A	30	GLU	CD-OE2	5.90	1.32	1.25
1	A	73	PHE	CG-CD1	-5.83	1.30	1.38
1	A	89[A]	GLU	CG-CD	-5.74	1.43	1.51
1	A	89[B]	GLU	CG-CD	-5.74	1.43	1.51
1	A	212	ASN	CB-CG	5.66	1.64	1.51
1	A	145	TYR	CE2-CZ	-5.44	1.31	1.38
1	A	134[A]	LYS	N-CA	5.42	1.57	1.46
1	A	134[B]	LYS	N-CA	5.42	1.57	1.46

All (33) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	241	ARG	NE-CZ-NH2	-14.33	113.13	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	24[A]	ARG	NE-CZ-NH2	11.36	125.98	120.30
1	A	24[B]	ARG	NE-CZ-NH2	11.36	125.98	120.30
1	A	241	ARG	NE-CZ-NH1	10.18	125.39	120.30
1	A	311	ASP	CB-CG-OD2	-10.13	109.18	118.30
1	A	148	ASP	CB-CG-OD1	10.07	127.36	118.30
1	A	134[A]	LYS	CG-CD-CE	7.97	135.82	111.90
1	A	134[B]	LYS	CG-CD-CE	7.97	135.82	111.90
1	A	295	ARG	NE-CZ-NH2	7.23	123.91	120.30
1	A	24[A]	ARG	CG-CD-NE	-6.78	97.56	111.80
1	A	24[B]	ARG	CG-CD-NE	-6.78	97.56	111.80
1	A	24[A]	ARG	CA-C-N	-6.67	102.51	117.20
1	A	24[B]	ARG	CA-C-N	-6.67	102.51	117.20
1	A	2	ARG	NE-CZ-NH1	6.63	123.61	120.30
1	A	306	ARG	NE-CZ-NH2	-6.55	117.03	120.30
1	A	30	GLU	OE1-CD-OE2	-6.24	115.81	123.30
1	A	340	GLU	CA-C-O	-6.03	107.44	120.10
1	A	282	ARG	NE-CZ-NH1	5.95	123.27	120.30
1	A	2	ARG	NE-CZ-NH2	-5.92	117.34	120.30
1	A	142[A]	ASP	CB-CG-OD1	-5.91	112.98	118.30
1	A	142[B]	ASP	CB-CG-OD1	-5.91	112.98	118.30
1	A	109[A]	ASP	CB-CG-OD2	-5.72	113.15	118.30
1	A	109[B]	ASP	CB-CG-OD2	-5.72	113.15	118.30
1	A	148	ASP	CB-CG-OD2	-5.72	113.15	118.30
1	A	70	ASP	CB-CG-OD2	-5.56	113.29	118.30
1	A	142[A]	ASP	N-CA-CB	-5.54	100.64	110.60
1	A	142[B]	ASP	N-CA-CB	-5.54	100.64	110.60
1	A	303	ASP	CB-CG-OD2	-5.29	113.54	118.30
1	A	316	ARG	NE-CZ-NH2	-5.21	117.70	120.30
1	A	108	GLU	OE1-CD-OE2	5.17	129.51	123.30
1	A	295	ARG	CD-NE-CZ	5.14	130.80	123.60
1	A	165	VAL	C-N-CA	5.14	134.55	121.70
1	A	73	PHE	CB-CG-CD2	-5.11	117.22	120.80

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	194	TYR	Sidechain
1	A	241	ARG	Sidechain
1	A	293[A]	GLY	Peptide
1	A	30	GLU	Sidechain

## 5.2 Too-close contacts ⓘ

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	2744	0	2714	13	0
2	A	385	0	0	5	0
All	All	3129	0	2714	13	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 2.

All (13) 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:24[A]:ARG:HD2	2:A:641:HOH:O	1.46	1.11
1:A:109[B]:ASP:OD2	2:A:704:HOH:O	2.07	0.72
1:A:59:GLU:OE2	1:A:134[A]:LYS:HE2	1.94	0.67
1:A:134[A]:LYS:HD3	1:A:137:PRO:HA	1.79	0.65
1:A:142[A]:ASP:OD2	1:A:144:TRP:CD1	2.56	0.58
1:A:89[A]:GLU:CD	2:A:781:HOH:O	2.42	0.57
1:A:24[A]:ARG:HD3	1:A:224:ASP:O	2.10	0.52
1:A:142[A]:ASP:OD2	1:A:144:TRP:HD1	1.94	0.50
1:A:134[A]:LYS:HG3	1:A:165:VAL:HB	1.97	0.45
1:A:59:GLU:OE2	1:A:134[A]:LYS:CE	2.65	0.43
1:A:28:LYS:HE2	2:A:626:HOH:O	2.19	0.42
1:A:213[A]:THR:HG22	1:A:214:TYR:O	2.20	0.41
1:A:47[A]:GLN:HG2	2:A:779:HOH:O	2.21	0.41

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	356/348 (102%)	341 (96%)	14 (4%)	1 (0%)	41 15

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	166	CYS

### 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	296/285 (104%)	293 (99%)	3 (1%)	76 44

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

Mol	Chain	Res	Type
1	A	5	ASP
1	A	192	TYR
1	A	193	MET

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

### 5.3.3 RNA ⓘ

There are no RNA molecules 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 [i](#)

There are no carbohydrates 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 [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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	340/348 (97%)	-0.17	1 (0%) 94 91	3, 5, 12, 24	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	166	CYS	2.7

### 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 carbohydrates 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.