



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 12, 2021 – 08:15 AM EDT

PDB ID : 1YHV  
Title : Crystal Structure of PAK1 kinase domain with two point mutations (K299R, T423E)  
Authors : Lei, M.; Robinson, M.A.; Harrison, S.C.  
Deposited on : 2005-01-10  
Resolution : 1.80 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 : 2.23.2  
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) : 2.23.2

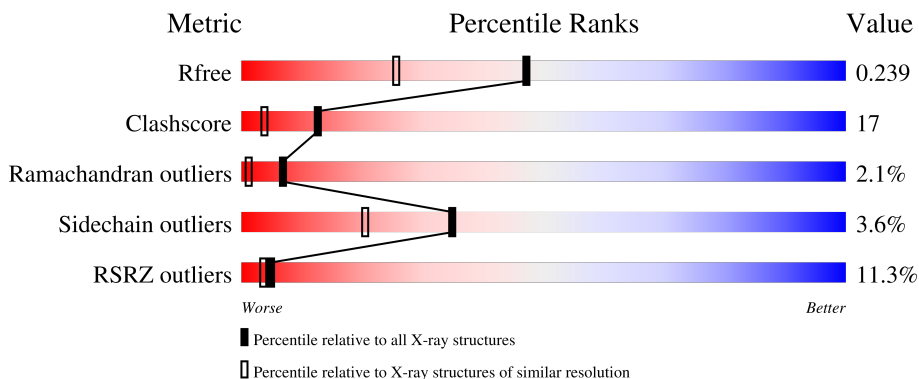
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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	297	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2488 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 Serine/threonine-protein kinase PAK 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	293	2270	1440	376	438	16	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	299	ARG	LYS	engineered mutation	UNP Q13153
A	423	GLU	THR	engineered mutation	UNP Q13153

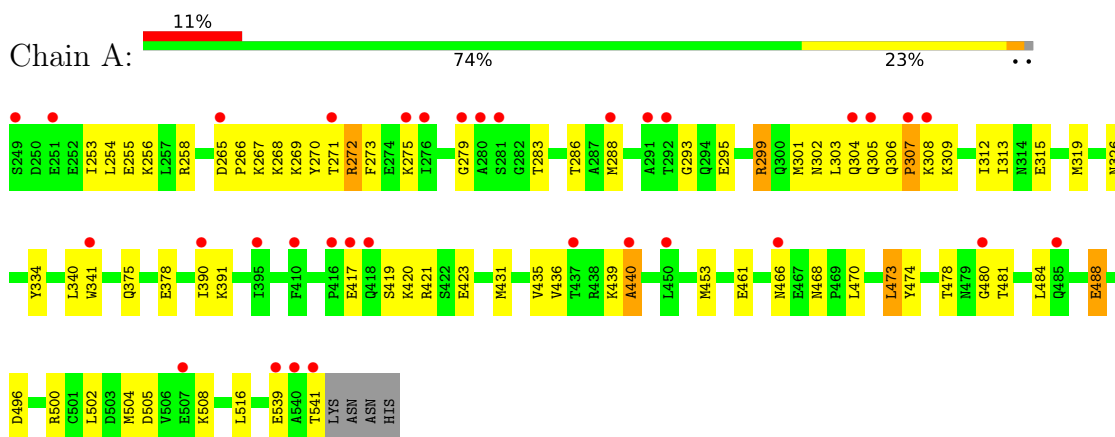
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	218	Total	O	0	0
			218	218		

### 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: Serine/threonine-protein kinase PAK 1



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	51.96Å 103.30Å 122.88Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 1.80 26.40 – 1.80	Depositor EDS
% Data completeness (in resolution range)	(Not available) (50.00-1.80) 98.2 (26.40-1.80)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	0.25	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.12 (at 1.80Å)	Xtrriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.220 , 0.240 0.223 , 0.239	Depositor DCC
$R_{free}$ test set	1514 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	27.5	Xtrriage
Anisotropy	0.572	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.39 , 54.5	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	0.94	EDS
Total number of atoms	2488	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	36.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.09% 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	0.41	0/2308	0.74	0/3127

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	2270	0	2277	76	0
2	A	218	0	0	10	0
All	All	2488	0	2277	76	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 17.

All (76) 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:309:LYS:O	1:A:312:ILE:HG22	1.55	1.04
1:A:271:THR:HG22	1:A:272:ARG:N	1.73	1.01
1:A:436:VAL:HG21	1:A:473:LEU:HD23	1.53	0.90
1:A:293:GLY:HA2	2:A:170:HOH:O	1.79	0.82

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:391:LYS:HA	1:A:453:MET:HE2	1.62	0.82
1:A:481:THR:HG22	1:A:502:LEU:O	1.81	0.81
1:A:266:PRO:HG2	1:A:341:TRP:CE3	2.17	0.79
1:A:474:TYR:O	1:A:478:THR:HG23	1.88	0.74
1:A:436:VAL:CG2	1:A:473:LEU:HD23	2.17	0.73
1:A:271:THR:HG22	1:A:272:ARG:H	1.54	0.72
1:A:271:THR:CG2	1:A:272:ARG:N	2.47	0.71
1:A:391:LYS:N	1:A:453:MET:HE1	2.06	0.70
1:A:481:THR:HG23	1:A:504:MET:HG2	1.72	0.70
1:A:306:GLN:HG3	2:A:208:HOH:O	1.92	0.69
1:A:390:ILE:HG22	1:A:453:MET:HE3	1.75	0.69
1:A:391:LYS:CA	1:A:453:MET:HE2	2.23	0.67
1:A:436:VAL:HG21	1:A:473:LEU:CD2	2.24	0.67
1:A:307:PRO:HB2	1:A:308:LYS:HD2	1.76	0.66
1:A:539:GLU:C	1:A:541:THR:H	1.99	0.66
1:A:275:LYS:HE3	1:A:283:THR:HG23	1.79	0.65
1:A:378:GLU:OE1	1:A:516:LEU:CD1	2.44	0.64
1:A:288:MET:HG3	2:A:116:HOH:O	1.97	0.64
1:A:391:LYS:CA	1:A:453:MET:CE	2.75	0.64
1:A:468:ASN:OD1	1:A:470:LEU:HG	1.98	0.63
1:A:288:MET:HE2	2:A:116:HOH:O	1.98	0.62
1:A:326:ASN:ND2	1:A:375:GLN:HE21	2.01	0.59
1:A:326:ASN:HD21	1:A:375:GLN:HE21	1.49	0.58
1:A:309:LYS:O	1:A:312:ILE:CG2	2.42	0.57
1:A:312:ILE:CD1	1:A:340:LEU:HD23	2.35	0.57
1:A:436:VAL:CG2	1:A:473:LEU:CD2	2.81	0.57
1:A:266:PRO:HG2	1:A:341:TRP:CD2	2.40	0.57
1:A:378:GLU:OE1	1:A:516:LEU:HD13	2.04	0.57
1:A:390:ILE:HG22	1:A:453:MET:CE	2.35	0.56
1:A:255:GLU:OE1	1:A:258:ARG:NH1	2.38	0.56
1:A:265:ASP:OD2	1:A:267:LYS:HB2	2.06	0.56
1:A:271:THR:O	1:A:273:PHE:HD1	1.90	0.55
1:A:474:TYR:CE1	1:A:478:THR:HG21	2.41	0.54
1:A:312:ILE:HD11	1:A:340:LEU:HD23	1.90	0.53
1:A:269:LYS:HD3	1:A:270:TYR:CZ	2.44	0.52
1:A:266:PRO:HG3	1:A:334:TYR:CG	2.45	0.51
1:A:253:ILE:HD13	1:A:309:LYS:HB2	1.93	0.50
1:A:500:ARG:HD3	2:A:90:HOH:O	2.12	0.49
1:A:254:LEU:O	1:A:258:ARG:HG3	2.13	0.48
1:A:256:LYS:HG2	1:A:313:ILE:HD13	1.95	0.48
1:A:268:LYS:HE3	2:A:168:HOH:O	2.11	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:326:ASN:HD21	1:A:375:GLN:NE2	2.11	0.47
1:A:391:LYS:N	1:A:453:MET:CE	2.76	0.47
1:A:267:LYS:HE2	1:A:341:TRP:CH2	2.50	0.47
1:A:265:ASP:OD2	1:A:267:LYS:CB	2.63	0.46
1:A:505:ASP:HB3	1:A:508:LYS:HB2	1.98	0.46
1:A:480:GLY:HA2	1:A:504:MET:SD	2.56	0.46
1:A:391:LYS:CA	1:A:453:MET:HE1	2.43	0.45
1:A:488:GLU:H	1:A:488:GLU:CD	2.18	0.45
1:A:496:ASP:O	1:A:500:ARG:HG2	2.17	0.45
1:A:267:LYS:HE2	1:A:341:TRP:HH2	1.82	0.45
1:A:302:ASN:HB3	1:A:305:GLN:HG2	2.00	0.44
1:A:303:LEU:HD22	1:A:309:LYS:HD3	1.99	0.44
1:A:468:ASN:OD1	1:A:470:LEU:CG	2.65	0.44
1:A:303:LEU:O	1:A:305:GLN:N	2.51	0.44
1:A:436:VAL:HG23	2:A:111:HOH:O	2.17	0.44
1:A:539:GLU:C	1:A:541:THR:N	2.70	0.44
1:A:391:LYS:HA	1:A:453:MET:CE	2.38	0.44
1:A:481:THR:CG2	1:A:504:MET:HG2	2.46	0.43
1:A:266:PRO:HG3	1:A:334:TYR:CB	2.48	0.43
1:A:306:GLN:HA	1:A:307:PRO:HD2	1.82	0.43
1:A:286:THR:HG21	1:A:295:GLU:OE1	2.19	0.43
1:A:315:GLU:O	1:A:319:MET:HG3	2.18	0.43
1:A:312:ILE:HG23	1:A:313:ILE:N	2.34	0.42
1:A:421:ARG:O	1:A:440:ALA:HA	2.20	0.42
1:A:299:ARG:HD2	1:A:301:MET:SD	2.60	0.42
1:A:312:ILE:HD13	1:A:340:LEU:HD23	2.01	0.42
1:A:481:THR:HG21	2:A:173:HOH:O	2.18	0.42
1:A:309:LYS:C	1:A:312:ILE:HG22	2.34	0.41
1:A:435:VAL:HB	2:A:111:HOH:O	2.20	0.41
1:A:439:LYS:O	1:A:440:ALA:C	2.59	0.40
1:A:431:MET:HB3	2:A:111:HOH:O	2.22	0.40

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	291/297 (98%)	273 (94%)	12 (4%)	6 (2%)	7 1

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	272	ARG
1	A	440	ALA
1	A	279	GLY
1	A	417	GLU
1	A	304	GLN
1	A	307	PRO

### 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	248/258 (96%)	239 (96%)	9 (4%)	35 20

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	299	ARG
1	A	419	SER
1	A	420	LYS
1	A	423	GLU
1	A	461	GLU
1	A	466	ASN
1	A	473	LEU
1	A	484	LEU
1	A	488	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	326	ASN
1	A	383	ASN
1	A	418	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](#)

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

### 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	293/297 (98%)	0.59	33 (11%) <b>5</b> <b>3</b>	19, 33, 60, 66	0

All (33) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	440	ALA	5.9
1	A	417	GLU	5.6
1	A	418	GLN	5.1
1	A	281	SER	4.9
1	A	280	ALA	4.8
1	A	279	GLY	4.6
1	A	276	ILE	4.4
1	A	271	THR	4.1
1	A	308	LYS	3.9
1	A	275	LYS	3.4
1	A	305	GLN	3.4
1	A	288	MET	3.4
1	A	304	GLN	3.3
1	A	539	GLU	3.2
1	A	480	GLY	3.0
1	A	437	THR	3.0
1	A	291	ALA	3.0
1	A	307	PRO	2.7
1	A	416	PRO	2.7
1	A	466	ASN	2.6
1	A	485	GLN	2.5
1	A	450	LEU	2.5
1	A	390	ILE	2.5
1	A	395	ILE	2.4
1	A	541	THR	2.4
1	A	507	GLU	2.4
1	A	540	ALA	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	249	SER	2.3
1	A	251	GLU	2.1
1	A	265	ASP	2.1
1	A	292	THR	2.0
1	A	410	PHE	2.0
1	A	341	TRP	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.