



Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 2R0I / pdb_00002r0i
Title : Crystal structure of a kinase MARK2/Par-1 mutant
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Deposited on : 2007-08-20
Resolution : 2.20 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

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>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

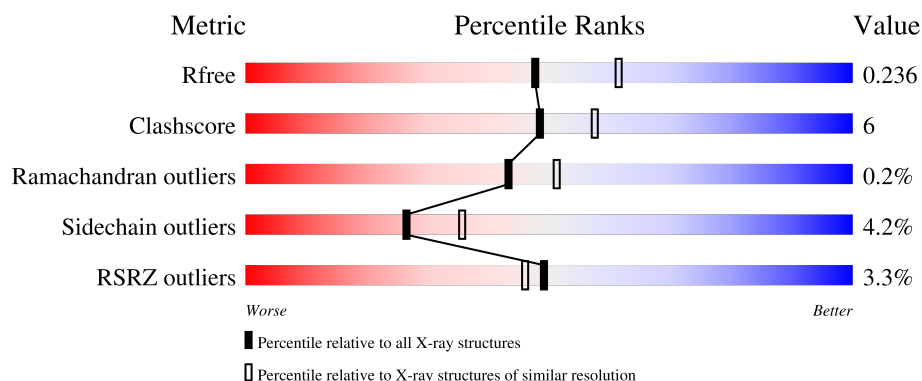
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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}	180053	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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 ≥ 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	327	
1	B	327	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4895 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 MARK2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	300	Total	C	N	O	S	0	3	0
			2396	1545	405	432	14			
1	B	300	Total	C	N	O	S	0	3	0
			2388	1542	406	427	13			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	38	GLY	-	expression tag	UNP O08679
A	318	ALA	GLU	engineered mutation	UNP O08679
B	38	GLY	-	expression tag	UNP O08679
B	318	ALA	GLU	engineered mutation	UNP O08679

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	56	Total	O	0	0
			56	56		
2	B	55	Total	O	0	0
			55	55		

4 Data and refinement statistics

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, α , β , γ	120.41 Å 120.41 Å 99.92 Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	40.00 – 2.20 40.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.1 (40.00-2.20) 99.1 (40.00-2.20)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.90 (at 2.20 Å)	Xtriage
Refinement program	REFMAC refmac_5.2.0019	Depositor
R, R_{free}	0.192 , 0.239 0.191 , 0.236	Depositor DCC
R_{free} test set	2112 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	48.7	Xtriage
Anisotropy	0.027	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 51.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.031 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4895	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.51% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	1.32	3/2450 (0.1%)	1.17	11/3305 (0.3%)
1	B	1.31	3/2445 (0.1%)	1.15	6/3300 (0.2%)
All	All	1.31	6/4895 (0.1%)	1.16	17/6605 (0.3%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	269	ILE	CA-C	6.40	1.58	1.53
1	A	128	VAL	CA-CB	-6.29	1.46	1.54
1	A	75	THR	CA-CB	6.24	1.62	1.54
1	A	50	ILE	CA-C	-6.02	1.45	1.52
1	B	122	GLU	CA-C	-5.42	1.46	1.52
1	B	128	VAL	CA-CB	-5.39	1.47	1.54

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	213	PRO	N-CA-C	6.78	118.97	110.70
1	A	213	PRO	N-CA-C	6.65	118.81	110.70
1	B	66	LYS	N-CA-C	-6.32	99.10	109.40
1	A	292	ARG	NE-CZ-NH1	6.32	127.82	121.50
1	A	69	LEU	N-CA-C	-6.29	99.76	109.76
1	A	212	SER	CA-C-N	-6.13	114.06	120.38
1	A	212	SER	C-N-CA	-6.13	114.06	120.38
1	A	292	ARG	CD-NE-CZ	5.96	132.74	124.40
1	A	292	ARG	NE-CZ-NH2	-5.85	113.94	119.20
1	B	292	ARG	NE-CZ-NH2	-5.73	114.05	119.20
1	A	52	ASN	N-CA-CB	-5.39	102.39	110.91
1	A	50	ILE	N-CA-C	-5.35	100.14	108.81
1	B	178	ALA	CA-C-N	5.29	129.06	120.60
1	B	178	ALA	C-N-CA	5.29	129.06	120.60
1	B	193	ASP	N-CA-C	5.12	121.70	110.80
1	A	318	ALA	CA-C-N	5.02	126.11	119.84

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	318	ALA	C-N-CA	5.02	126.11	119.84

There are no chirality outliers.

There are no planarity outliers.

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	2396	0	2413	28	0
1	B	2388	0	2406	26	0
2	A	56	0	0	3	0
2	B	55	0	0	1	0
All	All	4895	0	4819	53	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 6.

All (53) 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:B:225:LYS:H	1:B:225:LYS:HD2	1.23	1.01
1:A:50:ILE:HD12	1:A:51:GLY:H	1.26	1.00
1:B:225:LYS:H	1:B:225:LYS:CD	1.74	0.99
1:A:225:LYS:HE2	1:A:225:LYS:H	1.25	0.97
1:B:339:ARG:HG2	1:B:339:ARG:HH11	1.29	0.93
1:B:339:ARG:HG2	1:B:339:ARG:NH1	1.99	0.78
1:A:50:ILE:HD12	1:A:51:GLY:N	1.98	0.77
1:B:343:GLN:HE21	1:B:343:GLN:HA	1.51	0.76
1:B:339:ARG:NH1	1:B:339:ARG:CG	2.52	0.72
1:A:238:VAL:O	1:A:242:THR:HG23	1.92	0.69
1:A:54:ARG:HB2	1:A:73:ILE:HD11	1.74	0.68
1:A:104[B]:MET:HE1	1:A:127:LEU:HD13	1.76	0.67
1:B:286:ILE:O	1:B:292:ARG:HD3	1.96	0.66
1:A:104[B]:MET:CE	1:A:127:LEU:HD13	2.25	0.65
1:A:251:ASP:O	1:A:261:ARG:HD2	1.96	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:337:TYR:CD1	1:A:354:VAL:HG22	2.32	0.65
1:B:104[B]:MET:HE1	1:B:129:MET:HE1	1.81	0.63
1:B:54:ARG:HB2	1:B:73:ILE:HD11	1.81	0.63
1:A:140:TYR:O	1:A:144[B]:HIS:HB3	1.99	0.62
1:A:337:TYR:CE1	1:A:354:VAL:HG22	2.36	0.60
1:A:173:HIS:O	1:A:174:ARG:HB2	2.03	0.58
1:B:225:LYS:HD2	1:B:225:LYS:N	2.07	0.58
1:B:225:LYS:CD	1:B:225:LYS:N	2.58	0.57
1:A:61:LYS:HG3	1:A:66:LYS:HG2	1.88	0.56
1:A:226:TYR:HB3	1:B:256:LYS:HG3	1.86	0.55
1:A:286:ILE:O	1:A:292:ARG:HD3	2.07	0.54
1:A:280:LEU:HD13	1:A:301:ASP:CG	2.32	0.54
1:B:295:LEU:O	1:B:299:MET:HG3	2.08	0.54
1:B:220:LEU:HB2	1:B:226:TYR:CE1	2.44	0.53
1:B:339:ARG:HH11	1:B:339:ARG:CG	1.96	0.51
1:B:288:ASN:C	1:B:288:ASN:HD22	2.18	0.50
1:B:173:HIS:O	1:B:174:ARG:HB2	2.12	0.49
1:B:101:VAL:HG22	1:B:127:LEU:HD21	1.93	0.49
1:B:104[B]:MET:CE	1:B:127:LEU:HD13	2.45	0.47
1:B:238:VAL:O	1:B:242:THR:HG23	2.14	0.47
1:B:343:GLN:HE21	1:B:343:GLN:CA	2.18	0.47
1:A:50:ILE:O	1:A:51:GLY:C	2.58	0.47
1:A:293:GLY:N	2:A:401:HOH:O	2.37	0.47
1:B:352:ASN:HB2	2:B:400:HOH:O	2.16	0.45
1:A:52:ASN:O	1:A:73:ILE:HG12	2.16	0.45
1:A:220:LEU:HB2	1:A:226:TYR:CE2	2.52	0.45
1:A:244:VAL:HG21	1:A:273:MET:HE2	1.99	0.44
1:B:343:GLN:HA	1:B:343:GLN:NE2	2.26	0.44
1:A:297:GLN:HG3	2:A:386:HOH:O	2.18	0.43
1:A:54:ARG:HB2	1:A:73:ILE:CD1	2.46	0.43
1:A:104[A]:MET:HE1	1:A:113:VAL:HG12	2.00	0.43
1:A:186:ASP:O	1:A:187[B]:MET:HB2	2.19	0.42
1:B:326:PRO:O	1:B:330:GLU:HG2	2.20	0.42
1:A:75:THR:HG22	1:A:361:LEU:HD23	2.02	0.41
1:B:320:LEU:HA	1:B:321:PRO:HD3	1.94	0.41
1:B:104[B]:MET:HE1	1:B:127:LEU:HD13	2.01	0.41
1:A:236:LEU:HD23	1:A:236:LEU:HA	1.98	0.40
1:A:146:ARG:HD2	2:A:374:HOH:O	2.21	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	299/327 (91%)	289 (97%)	10 (3%)	0	100	100
1	B	299/327 (91%)	290 (97%)	8 (3%)	1 (0%)	36	42
All	All	598/654 (91%)	579 (97%)	18 (3%)	1 (0%)	43	51

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	193	ASP

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	254/288 (88%)	242 (95%)	12 (5%)	23	31
1	B	251/288 (87%)	241 (96%)	10 (4%)	28	38
All	All	505/576 (88%)	483 (96%)	22 (4%)	26	34

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	50	ILE
1	A	100	GLU
1	A	106	VAL
1	A	151	GLU
1	A	187[A]	MET

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Mol	Chain	Res	Type
1	A	187[B]	MET
1	A	225	LYS
1	A	255	LEU
1	A	257	GLU
1	A	258	LEU
1	A	282	LYS
1	A	292	ARG
1	B	73	ILE
1	B	106	VAL
1	B	225	LYS
1	B	255	LEU
1	B	258	LEU
1	B	288	ASN
1	B	310	ASP
1	B	317	VAL
1	B	339	ARG
1	B	343	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	108	ASN
1	A	222	GLN
1	B	222	GLN
1	B	288	ASN
1	B	297	GLN
1	B	343	GLN

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 ⓘ

There are no oligosaccharides 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, 95th 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 ²)	Q<0.9
1	A	300/327 (91%)	0.31	11 (3%) 45 42	28, 47, 64, 74	3 (1%)
1	B	300/327 (91%)	0.16	9 (3%) 52 49	27, 47, 64, 74	3 (1%)
All	All	600/654 (91%)	0.24	20 (3%) 49 46	27, 47, 64, 74	6 (1%)

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	48	PRO	3.6
1	B	64	PHE	3.5
1	B	48	PRO	3.5
1	A	144[A]	HIS	3.2
1	B	252	GLY	3.0
1	A	145	GLY	3.0
1	A	141	LEU	2.9
1	A	363	TYR	2.9
1	A	50	ILE	2.8
1	A	73	ILE	2.7
1	B	62	GLY	2.7
1	B	144[A]	HIS	2.6
1	B	227	ASP	2.3
1	A	252	GLY	2.2
1	B	65	ALA	2.2
1	B	344	ASP	2.2
1	B	63	ASN	2.2
1	A	74	LEU	2.1
1	A	140	TYR	2.1
1	A	310	ASP	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 oligosaccharides 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.