



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 20, 2026 – 01:47 pm BST

PDB ID : 9RZX / pdb_00009rzx
Title : Crystal structure of Zg3464GH29, a GH29 α -L-fucosidase from *Zobellia galactanivorans*
Authors : Roret, T.; Matard-Mann, M.; Czjzek, M.; Michel, G.
Deposited on : 2025-07-16
Resolution : 2.24 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	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

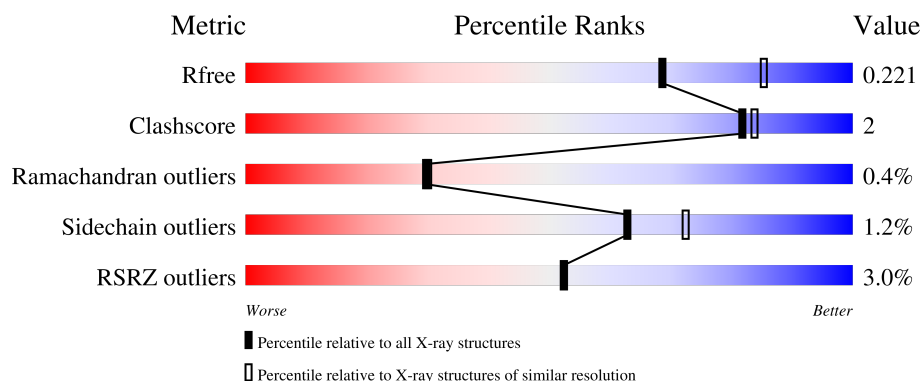
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

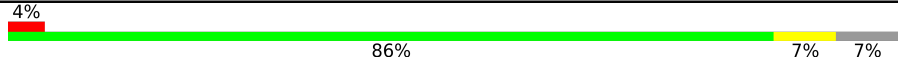
The reported resolution of this entry is 2.24 Å.

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	3416 (2.26-2.22)
Clashscore	190562	3556 (2.26-2.22)
Ramachandran outliers	187476	3500 (2.26-2.22)
Sidechain outliers	187428	3501 (2.26-2.22)
RSRZ outliers	180081	3415 (2.26-2.22)

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	602	
1	B	602	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 18140 atoms, of which 8618 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 Alpha-L-fucosidase, family GH29.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	560	Total	C	H	N	O	S	0	0	0
			8754	2839	4317	745	835	18			
1	B	558	Total	C	H	N	O	S	0	0	0
			8724	2830	4301	743	832	18			

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	3	Total	Ca	0	0
			3	3		
2	B	3	Total	Ca	0	0
			3	3		

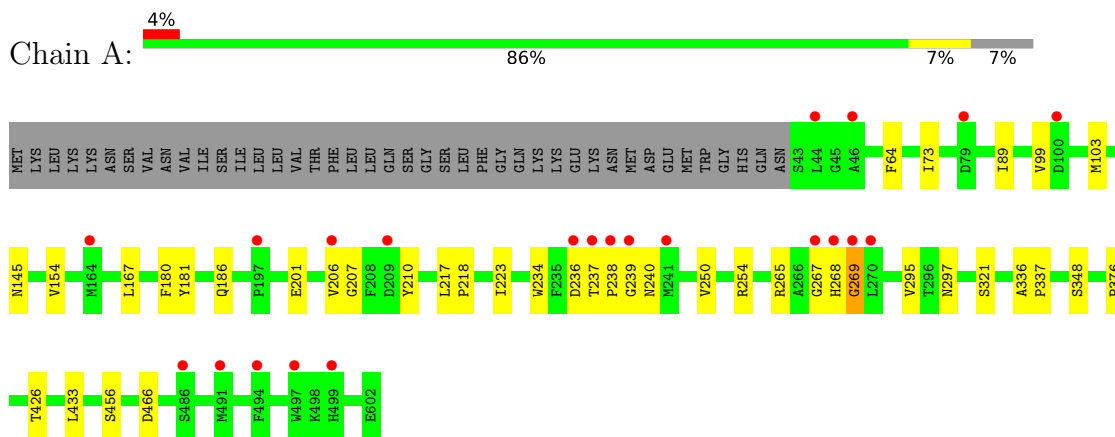
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	320	Total	O	0	0
			320	320		
3	B	336	Total	O	0	0
			336	336		

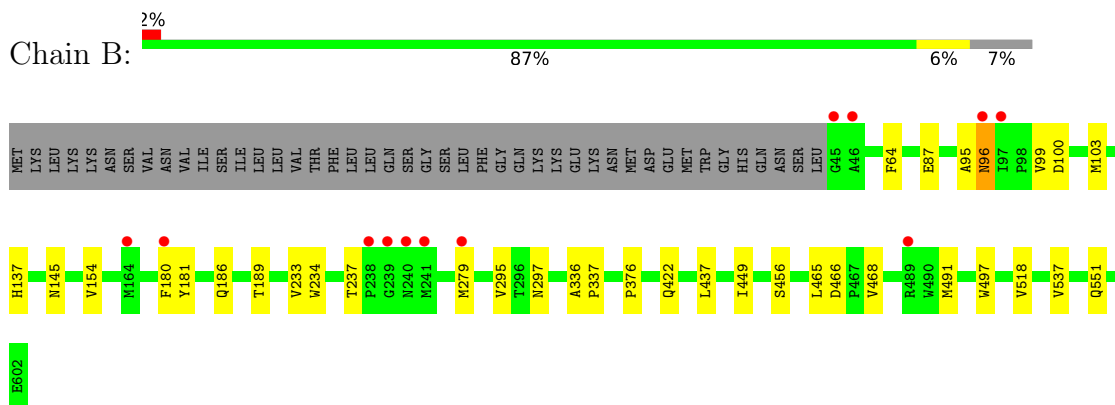
3 Residue-property plots [i](#)

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: Alpha-L-fucosidase, family GH29



- Molecule 1: Alpha-L-fucosidase, family GH29



4 Data and refinement statistics

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, α , β , γ	117.81Å 117.81Å 91.17Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.51 – 2.24 42.51 – 2.24	Depositor EDS
% Data completeness (in resolution range)	100.0 (42.51-2.24) 100.0 (42.51-2.24)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.44 (at 2.24Å)	Xtriage
Refinement program	PHENIX 1.13	Depositor
R, R_{free}	0.172 , 0.210 0.186 , 0.221	Depositor DCC
R_{free} test set	3118 reflections (5.19%)	wwPDB-VP
Wilson B-factor (Å ²)	36.9	Xtriage
Anisotropy	0.314	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 35.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.029 for h,-k,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	18140	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.95% 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

Bond lengths and bond angles in the following residue types are not validated in this section: CA

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	0.13	0/4558	0.32	0/6180
1	B	0.15	0/4544	0.32	0/6161
All	All	0.14	0/9102	0.32	0/12341

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

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	4437	4317	4316	24	0
1	B	4423	4301	4300	19	0
2	A	3	0	0	0	0
2	B	3	0	0	0	0
3	A	320	0	0	1	0
3	B	336	0	0	1	0
All	All	9522	8618	8616	43	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 (43) 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:422:GLN:OE1	3:B:801:HOH:O	2.11	0.69
1:A:206:VAL:HG11	1:A:210:TYR:CG	2.28	0.68
1:A:186:GLN:NE2	1:A:237:THR:HG21	2.10	0.66
1:B:279:MET:HE1	1:B:497:TRP:H	1.62	0.62
1:A:186:GLN:HE21	1:A:237:THR:HG21	1.64	0.62
1:B:491:MET:HE3	1:B:497:TRP:CZ2	2.36	0.60
1:A:201:GLU:N	1:A:201:GLU:OE1	2.33	0.60
1:A:206:VAL:HG11	1:A:210:TYR:CB	2.36	0.55
1:B:336:ALA:HB1	1:B:337:PRO:HD2	1.89	0.54
1:A:99:VAL:HG12	1:A:103:MET:HE2	1.88	0.54
1:B:237:THR:O	1:B:237:THR:HG22	2.07	0.54
1:A:336:ALA:HB1	1:A:337:PRO:HD2	1.91	0.53
1:B:186:GLN:OE1	1:B:237:THR:HG21	2.10	0.52
1:B:99:VAL:CG1	1:B:103:MET:HE3	2.41	0.51
1:B:103:MET:HE2	1:B:189:THR:HB	1.93	0.51
1:A:206:VAL:HG12	1:A:207:GLY:N	2.24	0.50
1:A:145:ASN:HB2	1:A:154:VAL:HG21	1.92	0.50
1:B:336:ALA:HB1	1:B:337:PRO:CD	2.43	0.49
1:A:321:SER:OG	3:A:801:HOH:O	2.20	0.48
1:A:236:ASP:OD1	1:A:265:ARG:NE	2.47	0.47
1:B:295:VAL:HG23	1:B:297:ASN:O	2.15	0.47
1:A:206:VAL:CG1	1:A:210:TYR:CB	2.93	0.46
1:B:537:VAL:HG22	1:B:551:GLN:HB2	1.99	0.45
1:A:73:ILE:HG21	1:A:89:ILE:HG12	1.99	0.45
1:A:238:PRO:HG3	1:A:265:ARG:O	2.16	0.44
1:B:437:LEU:HD21	1:B:449:ILE:HD11	1.99	0.44
1:A:217:LEU:HB3	1:A:218:PRO:HD3	1.99	0.44
1:B:95:ALA:O	1:B:96:ASN:C	2.61	0.44
1:B:145:ASN:HB2	1:B:154:VAL:HG21	1.99	0.43
1:B:376:PRO:HG2	1:B:466:ASP:HB2	1.99	0.43
1:B:87:GLU:HG3	1:B:137:HIS:CE1	2.52	0.43
1:A:336:ALA:HB1	1:A:337:PRO:CD	2.48	0.43
1:B:181:TYR:C	1:B:181:TYR:CD1	2.96	0.43
1:B:465:LEU:HD22	1:B:518:VAL:HG22	2.01	0.43
1:A:206:VAL:CG1	1:A:210:TYR:HB2	2.50	0.42
1:A:295:VAL:HG23	1:A:297:ASN:O	2.20	0.42
1:A:181:TYR:CD1	1:A:181:TYR:C	2.97	0.42
1:A:180:PHE:CG	1:A:223:ILE:HG21	2.55	0.42
1:A:376:PRO:HG2	1:A:466:ASP:HB2	2.02	0.42
1:A:267:GLY:O	1:A:269:GLY:N	2.52	0.41
1:A:426:THR:HB	1:A:433:LEU:HD11	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:180:PHE:CE1	1:B:233:VAL:HG22	2.55	0.41
1:A:250:VAL:O	1:A:254:ARG:HG2	2.21	0.40

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	558/602 (93%)	539 (97%)	16 (3%)	3 (0%)	24	23
1	B	556/602 (92%)	536 (96%)	19 (3%)	1 (0%)	43	48
All	All	1114/1204 (92%)	1075 (96%)	35 (3%)	4 (0%)	30	30

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	268	HIS
1	B	96	ASN
1	A	269	GLY
1	A	239	GLY

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.

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	467/506 (92%)	461 (99%)	6 (1%)	61	71
1	B	465/506 (92%)	460 (99%)	5 (1%)	65	74
All	All	932/1012 (92%)	921 (99%)	11 (1%)	63	72

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	64	PHE
1	A	167	LEU
1	A	234	TRP
1	A	240	ASN
1	A	348	SER
1	A	456	SER
1	B	64	PHE
1	B	100	ASP
1	B	234	TRP
1	B	456	SER
1	B	468	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	91	ASN
1	A	184	HIS
1	A	186	GLN
1	A	240	ASN
1	A	422	GLN
1	A	463	ASN
1	B	96	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 6 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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, 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	560/602 (93%)	0.19	22 (3%)	43 43	29, 43, 77, 111	0
1	B	558/602 (92%)	-0.11	12 (2%)	62 64	26, 41, 75, 120	0
All	All	1118/1204 (92%)	0.04	34 (3%)	52 52	26, 42, 76, 120	0

All (34) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	241	MET	4.4
1	A	497	TRP	4.3
1	A	237	THR	4.2
1	A	238	PRO	4.2
1	B	45	GLY	4.2
1	A	241	MET	4.1
1	A	269	GLY	4.0
1	A	486	SER	3.7
1	A	46	ALA	3.6
1	A	239	GLY	3.4
1	B	46	ALA	3.2
1	A	270	LEU	3.1
1	B	96	ASN	3.0
1	B	180	PHE	3.0
1	B	97	ILE	3.0
1	B	239	GLY	3.0
1	A	100	ASP	2.9
1	B	238	PRO	2.8
1	A	206	VAL	2.8
1	A	491	MET	2.6
1	A	268	HIS	2.6
1	A	209	ASP	2.5
1	B	279	MET	2.3
1	A	79	ASP	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	494	PHE	2.2
1	A	197	PRO	2.2
1	A	164	MET	2.2
1	B	164	MET	2.2
1	A	44	LEU	2.1
1	A	267	GLY	2.1
1	B	489	ARG	2.1
1	A	499	HIS	2.1
1	A	236	ASP	2.1
1	B	240	ASN	2.1

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](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	CA	B	702	1/1	0.94	0.13	48,48,48,48	0
2	CA	A	702	1/1	0.95	0.11	46,46,46,46	0
2	CA	A	701	1/1	0.98	0.05	41,41,41,41	0
2	CA	B	701	1/1	0.99	0.06	44,44,44,44	0
2	CA	B	700	1/1	0.99	0.05	33,33,33,33	0
2	CA	A	700	1/1	1.00	0.03	33,33,33,33	0

6.5 Other polymers [i](#)

There are no such residues in this entry.