



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 05:01 AM UTC

PDB ID : 2EGG / pdb_00002egg
Title : Crystal Structure of Shikimate 5-Dehydrogenase (AroE) from *Geobacillus kaustophilus*
Authors : Bagautdinov, B.; Kunishima, N.; RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on : 2007-02-28
Resolution : 2.25 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

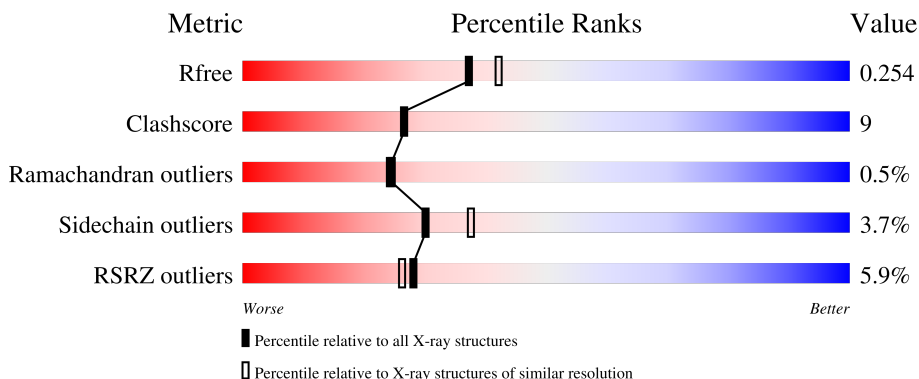
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.25 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	1898 (2.26-2.26)
Clashscore	190562	2005 (2.26-2.26)
Ramachandran outliers	187476	1965 (2.26-2.26)
Sidechain outliers	187428	1966 (2.26-2.26)
RSRZ outliers	180081	1898 (2.26-2.26)

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	297	 3% 74% 19% 6%
1	B	297	 5% 41% 13% 44%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3848 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 Shikimate 5-dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	278	2158	1365	392	394	7	0	0	0
1	B	166	1286	820	228	233	5	0	0	0

There are 42 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP Q5KWX7
A	2	GLY	-	expression tag	UNP Q5KWX7
A	3	SER	-	expression tag	UNP Q5KWX7
A	4	SER	-	expression tag	UNP Q5KWX7
A	5	HIS	-	expression tag	UNP Q5KWX7
A	6	HIS	-	expression tag	UNP Q5KWX7
A	7	HIS	-	expression tag	UNP Q5KWX7
A	8	HIS	-	expression tag	UNP Q5KWX7
A	9	HIS	-	expression tag	UNP Q5KWX7
A	10	HIS	-	expression tag	UNP Q5KWX7
A	11	SER	-	expression tag	UNP Q5KWX7
A	12	SER	-	expression tag	UNP Q5KWX7
A	13	GLY	-	expression tag	UNP Q5KWX7
A	14	GLU	-	expression tag	UNP Q5KWX7
A	15	ASN	-	expression tag	UNP Q5KWX7
A	16	LEU	-	expression tag	UNP Q5KWX7
A	17	TYR	-	expression tag	UNP Q5KWX7
A	18	PHE	-	expression tag	UNP Q5KWX7
A	19	GLN	-	expression tag	UNP Q5KWX7
A	20	GLY	-	expression tag	UNP Q5KWX7
A	21	HIS	-	expression tag	UNP Q5KWX7
B	1	MET	-	expression tag	UNP Q5KWX7
B	2	GLY	-	expression tag	UNP Q5KWX7
B	3	SER	-	expression tag	UNP Q5KWX7
B	4	SER	-	expression tag	UNP Q5KWX7

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Chain	Residue	Modelled	Actual	Comment	Reference
B	5	HIS	-	expression tag	UNP Q5KWX7
B	6	HIS	-	expression tag	UNP Q5KWX7
B	7	HIS	-	expression tag	UNP Q5KWX7
B	8	HIS	-	expression tag	UNP Q5KWX7
B	9	HIS	-	expression tag	UNP Q5KWX7
B	10	HIS	-	expression tag	UNP Q5KWX7
B	11	SER	-	expression tag	UNP Q5KWX7
B	12	SER	-	expression tag	UNP Q5KWX7
B	13	GLY	-	expression tag	UNP Q5KWX7
B	14	GLU	-	expression tag	UNP Q5KWX7
B	15	ASN	-	expression tag	UNP Q5KWX7
B	16	LEU	-	expression tag	UNP Q5KWX7
B	17	TYR	-	expression tag	UNP Q5KWX7
B	18	PHE	-	expression tag	UNP Q5KWX7
B	19	GLN	-	expression tag	UNP Q5KWX7
B	20	GLY	-	expression tag	UNP Q5KWX7
B	21	HIS	-	expression tag	UNP Q5KWX7

- Molecule 2 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total Cl 2 2	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	291	Total O 291 291	0	0
3	B	111	Total O 111 111	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	I 2 3	Depositor
Cell constants a, b, c, α , β , γ	171.39Å 171.39Å 171.39Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.54 – 2.25 36.54 – 2.25	Depositor EDS
% Data completeness (in resolution range)	99.1 (36.54-2.25) 99.1 (36.54-2.25)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.73 (at 2.24Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.218 , 0.255 0.219 , 0.254	Depositor DCC
R_{free} test set	1955 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å ²)	37.0	Xtrriage
Anisotropy	0.000	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 61.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.027 for -l,-k,-h	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3848	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.66% 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 [i](#)

5.1 Standard geometry [i](#)

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

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	0.39	0/2197	0.95	11/2973 (0.4%)
1	B	0.36	0/1311	0.91	7/1776 (0.4%)
All	All	0.38	0/3508	0.93	18/4749 (0.4%)

There are no bond length outliers.

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	262	GLY	N-CA-C	-6.61	105.34	115.66
1	A	209	ILE	N-CA-C	6.19	116.79	107.75
1	A	138	THR	N-CA-C	-6.19	100.11	109.95
1	B	34	GLU	N-CA-C	5.99	119.42	111.75
1	A	194	SER	N-CA-C	-5.98	101.91	110.59
1	B	81	ASN	N-CA-C	-5.82	101.91	110.52
1	B	78	ALA	N-CA-C	5.79	117.59	111.28
1	A	81	ASN	N-CA-C	-5.74	102.03	110.52
1	A	220	VAL	N-CA-C	5.72	119.11	111.44
1	A	36	SER	N-CA-C	5.72	118.52	110.23
1	B	89	ALA	N-CA-C	5.68	118.20	111.33
1	A	269	GLN	N-CA-C	-5.39	105.41	111.28
1	A	188	ARG	N-CA-C	-5.33	106.91	113.41
1	A	34	GLU	N-CA-C	5.32	118.56	111.75
1	A	205	TYR	N-CA-C	5.29	118.02	109.40
1	B	70	ALA	N-CA-C	-5.23	105.75	111.82
1	A	258	ARG	N-CA-C	-5.19	100.84	109.46
1	B	91	ILE	N-CA-C	5.04	118.97	112.67

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	2158	0	2186	35	0
1	B	1286	0	1281	33	0
2	A	2	0	0	0	0
3	A	291	0	0	5	0
3	B	111	0	0	1	0
All	All	3848	0	3467	64	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 9.

All (64) 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:99:GLU:HA	1:B:102:ARG:HE	1.35	0.91
1:A:112:ASN:HD21	1:A:115:GLY:H	1.23	0.82
1:A:54:ARG:HD3	1:B:54:ARG:HD3	1.66	0.78
1:A:179:GLU:O	1:A:183:ARG:HG3	1.92	0.69
1:A:170:MET:SD	1:A:181:LEU:HD23	2.34	0.68
1:A:48:ARG:NH1	3:A:1017:HOH:O	2.26	0.68
1:B:37:LEU:HD11	1:B:295:LEU:HD13	1.80	0.64
1:A:220:VAL:HG13	3:A:1197:HOH:O	1.97	0.64
1:A:186:ASP:O	1:A:187:GLU:HB2	1.99	0.63
1:A:112:ASN:ND2	1:A:115:GLY:H	1.96	0.62
1:A:147:ILE:HD13	1:A:225:LEU:HD22	1.81	0.62
1:B:138:THR:HG22	1:B:140:ASP:H	1.65	0.62
1:B:41:MET:HE2	1:B:291:VAL:HG22	1.80	0.61
1:A:112:ASN:HD22	1:A:112:ASN:C	2.06	0.61
1:A:74:ALA:HA	1:B:64:GLN:NE2	2.15	0.61
1:A:54:ARG:HD3	1:B:54:ARG:CD	2.32	0.59
1:A:197:GLU:O	1:A:201:ARG:HG2	2.01	0.58
1:B:287:MET:O	1:B:291:VAL:HG23	2.04	0.58
1:A:139:LEU:HD12	1:A:163:THR:HG21	1.84	0.57
1:A:74:ALA:HA	1:B:64:GLN:HE21	1.69	0.56
1:B:134:GLU:HG2	1:B:135:MET:CE	2.35	0.56
1:A:168:ILE:HD12	1:A:168:ILE:N	2.21	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:41:MET:HE2	1:B:291:VAL:CG2	2.36	0.56
1:A:168:ILE:O	1:A:190:SER:HB3	2.06	0.56
1:B:21:HIS:ND1	1:B:22:MET:N	2.55	0.55
1:B:237:SER:CB	1:B:260:GLN:HB3	2.38	0.52
1:A:167:ARG:HB2	1:A:189:ARG:O	2.10	0.52
1:B:237:SER:HB2	1:B:260:GLN:HB3	1.92	0.51
1:B:134:GLU:HG2	1:B:135:MET:HE3	1.90	0.51
1:A:112:ASN:ND2	1:A:112:ASN:C	2.68	0.51
1:A:216:MET:HE2	3:A:1198:HOH:O	2.11	0.50
1:B:239:ILE:O	1:B:262:GLY:HA3	2.11	0.50
1:B:99:GLU:CB	1:B:102:ARG:HH21	2.25	0.50
1:A:231:ARG:O	1:A:234:VAL:HG22	2.11	0.50
1:B:127:TYR:HB2	1:B:265:MET:HE3	1.94	0.49
1:A:200:THR:O	1:A:229:ARG:HD2	2.12	0.49
1:B:39:PRO:HD2	3:B:405:HOH:O	2.15	0.47
1:A:135:MET:O	1:A:137:ILE:HG23	2.14	0.47
1:A:229:ARG:HD3	3:A:1203:HOH:O	2.14	0.47
1:B:99:GLU:HB2	1:B:102:ARG:HH21	1.80	0.46
1:B:139:LEU:O	1:B:141:GLY:N	2.48	0.46
1:A:44:ASP:OD2	1:A:48:ARG:HD2	2.16	0.45
1:A:216:MET:HG2	1:A:217:HIS:N	2.33	0.45
1:A:209:ILE:HA	1:A:237:SER:O	2.18	0.44
1:A:267:VAL:HG21	1:A:288:LYS:HG2	1.98	0.44
1:A:21:HIS:ND1	1:A:21:HIS:N	2.60	0.44
1:A:161:LEU:HD23	1:A:168:ILE:HD13	2.00	0.44
1:A:224:PRO:HD2	1:A:248:TRP:CD1	2.52	0.44
1:B:128:VAL:O	1:B:132:GLU:HG2	2.18	0.43
1:A:195:LEU:O	1:A:199:GLU:HG3	2.18	0.43
1:B:295:LEU:HD12	1:B:295:LEU:HA	1.87	0.43
1:B:135:MET:O	1:B:137:ILE:HG23	2.19	0.43
1:B:260:GLN:HG2	1:B:261:ASN:O	2.19	0.42
1:B:99:GLU:CG	1:B:102:ARG:HH21	2.33	0.42
1:B:91:ILE:HB	1:B:92:PRO:HD3	2.02	0.42
1:B:134:GLU:O	1:B:135:MET:HE2	2.20	0.42
1:B:272:LEU:HD23	1:B:281:TRP:HZ3	1.85	0.42
1:B:261:ASN:HB3	1:B:263:VAL:HG23	2.02	0.41
1:B:38:SER:N	1:B:39:PRO:CD	2.84	0.41
1:A:260:GLN:HG2	1:A:261:ASN:O	2.21	0.41
1:A:176:GLU:HB3	3:A:1282:HOH:O	2.20	0.41
1:B:134:GLU:C	1:B:135:MET:HE2	2.46	0.41
1:A:224:PRO:HD2	1:A:248:TRP:CG	2.56	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:100:HIS:CE1	1:B:104:ILE:HD11	2.57	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	276/297 (93%)	267 (97%)	9 (3%)	0	100	100
1	B	160/297 (54%)	152 (95%)	6 (4%)	2 (1%)	9	6
All	All	436/594 (73%)	419 (96%)	15 (3%)	2 (0%)	24	24

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	141	GLY
1	B	140	ASP

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	222/239 (93%)	214 (96%)	8 (4%)	31	39
1	B	133/239 (56%)	128 (96%)	5 (4%)	29	36
All	All	355/478 (74%)	342 (96%)	13 (4%)	30	37

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	HIS
1	A	85	PRO
1	A	88	LEU
1	A	140	ASP
1	A	145	LEU
1	A	176	GLU
1	A	202	LEU
1	A	228	GLU
1	B	85	PRO
1	B	88	LEU
1	B	142	LYS
1	B	143	ARG
1	B	295	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	112	ASN
1	A	129	GLN
1	A	136	ASN
1	A	289	GLN
1	B	64	GLN
1	B	81	ASN
1	B	136	ASN
1	B	280	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 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	278/297 (93%)	0.05	10 (3%) 46 46	21, 36, 63, 87	0
1	B	166/297 (55%)	0.62	16 (9%) 13 12	22, 42, 75, 94	0
All	All	444/594 (74%)	0.26	26 (5%) 28 26	21, 38, 73, 94	0

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	218	PRO	5.9
1	A	217	HIS	4.5
1	B	143	ARG	4.5
1	B	138	THR	4.5
1	B	139	LEU	4.2
1	A	187	GLU	4.0
1	A	176	GLU	4.0
1	B	142	LYS	3.9
1	A	20	GLY	3.8
1	B	141	GLY	3.8
1	B	140	ASP	3.7
1	B	21	HIS	3.5
1	B	237	SER	3.4
1	A	219	ARG	3.2
1	B	103	ARG	2.8
1	B	261	ASN	2.7
1	A	21	HIS	2.6
1	B	263	VAL	2.5
1	A	289	GLN	2.4
1	B	239	ILE	2.4
1	B	88	LEU	2.3
1	A	215	GLY	2.3
1	B	125	LEU	2.2
1	B	101	ALA	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	64	GLN	2.0
1	B	242	ASN	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](#)

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	CL	A	1001	1/1	0.88	0.20	65,65,65,65	0
2	CL	A	1002	1/1	0.98	0.04	35,35,35,35	0

6.5 Other polymers [i](#)

There are no such residues in this entry.