WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 7, 2023 – 08:37 AM EDT

PDB ID	:	4FXY
Title	:	Crystal structure of rat neurolysin with bound pyrazolidin inhibitor
Authors	:	Rodgers, D.W.; Hines, C.S.
Deposited on	:	2012-07-03
Resolution	:	2.80 Å(reported)

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

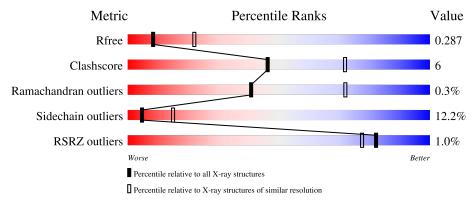|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

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 2.80 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	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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 >=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 <=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	P	693	74% 20%
1	Q	693	72% 21%

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 11003 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 Neurolysin, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	P	664	5335	3382	905	1014	34	0	0	0
1	Q	664	Total	C	N	O	S	0	0	0
			5335	3382	905	1014	34			

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
P	-11	ASP	-	expression tag	UNP P42676
P	-10	ARG	-	expression tag	UNP P42676
P	-9	TRP	-	expression tag	UNP P42676
P	-8	ILE	-	expression tag	UNP P42676
P	-7	ARG	-	expression tag	UNP P42676
P	-6	PRO	-	expression tag	UNP P42676
P	-5	ARG	-	expression tag	UNP P42676
P	-4	ASP	-	expression tag	UNP P42676
P	-3	LEU	-	expression tag	UNP P42676
P	-2	GLN	-	expression tag	UNP P42676
P	-1	MET	-	expression tag	UNP P42676
P	0	VAL	-	expression tag	UNP P42676
P	160	ALA	HIS	engineered mutation	UNP P42676
Q	-11	ASP	-	expression tag	UNP P42676
Q	-10	ARG	-	expression tag	UNP P42676
Q	-9	TRP	-	expression tag	UNP P42676
Q	-8	ILE	-	expression tag	UNP P42676
Q	-7	ARG	-	expression tag	UNP P42676
Q	-6	PRO	-	expression tag	UNP P42676
Q	-5	ARG	-	expression tag	UNP P42676
Q	-4	ASP	-	expression tag	UNP P42676
Q	-3	LEU	-	expression tag	UNP P42676
Q	-2	GLN	-	expression tag	UNP P42676
Q	-1	MET	-	expression tag	UNP P42676
Q	0	VAL	-	expression tag	UNP P42676

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Chain	Residue	Modelled	Actual	Comment	Reference
Q	160	ALA	HIS	engineered mutation	UNP P42676

- Molecule 2 is 1-{(2S)-1-[(3R)-3-(2-chlorophenyl)-2-(2-fluorophenyl)pyrazolidin-1-yl]-1-oxo propan-2-yl}-3-[(1R,3S,5R,7R)-tricyclo[3.3.1.1 3,7]dec-2-yl]urea (three-letter code: 0W2) (formula: $C_{29}H_{34}ClFN_4O_2$).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	P	1	Total	C	Cl	F	N	O	0	0
			37	29	1	1	4	2		
2	Q	1	Total	C	Cl	F	N	O	0	0
			37	29	1	1	4	2		

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	P	1	Total	Zn	0	0
			1	1		
3	Q	1	Total	Zn	0	0
			1	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	P	127	Total	O	0	0
			127	127		

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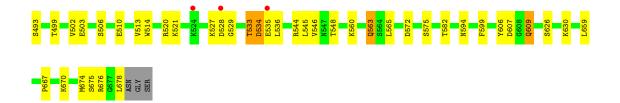| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	Q	130	Total 130	O 130	0	0

3 Residue-property plots ⓘ

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: Neurolysin, mitochondrial

Chain P:

• Molecule 1: Neurolysin, mitochondrial

Chain Q:

S493 T499 V502 E503 S506 E510 V513 W514 R520 K521 K524 K527 D528 G529 T533 D534 E535 L536 R544 L545 V546 N547 T548 K560 Q563 S564 L565 D572 S575 T582 N594 F599 Y606 D607 G608 Q609 S626 K630 L659

P667 K670 M674 S675 R676 G677 L678 ASN GLY SER

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	88.00Å 131.40Å 144.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.65 – 2.80 48.65 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.6 (48.65-2.80) 99.7 (48.65-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.16	Depositor
$< I/\sigma(I) >$ [1]	3.21 (at 2.81Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7.2_869), CNS	Depositor
R, R_{free}	0.235 , 0.287 0.236 , 0.287	Depositor DCC
R_{free} test set	4186 reflections (9.98%)	wwPDB-VP
Wilson B-factor (Å^2)	22.7	Xtriage
Anisotropy	0.700	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 36.5	EDS
L-test for twinning[2]	$< |L| > = 0.48, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	11003	wwPDB-VP
Average B, all atoms (Å^2)	35.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 46.43 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.1457e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: ZN, 0W2

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	P	0.29	2/5443 (0.0%)	0.43	0/7347
1	Q	0.29	2/5443 (0.0%)	0.43	0/7347
All	All	0.29	4/10886 (0.0%)	0.43	0/14694

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	P	344	GLN	CD-NE2	-6.47	1.16	1.32
1	Q	344	GLN	CD-NE2	-6.30	1.17	1.32
1	Q	344	GLN	CD-OE1	-5.76	1.11	1.24
1	P	344	GLN	CD-OE1	-5.12	1.12	1.24

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	P	5335	0	5292	64	0
1	Q	5335	0	5292	71	0
2	P	37	0	34	0	0
2	Q	37	0	34	1	0
3	P	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	Q	1	0	0	0	0
4	P	127	0	0	9	1
4	Q	130	0	0	16	1
All	All	11003	0	10652	135	1

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.

The worst 5 of 135 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:Q:535:GLU:OE1	4:Q:907:HOH:O	1.86	0.92
1:P:266:GLN:OE1	4:P:805:HOH:O	1.90	0.88
1:Q:160:ALA:O	4:Q:852:HOH:O	1.92	0.87
1:Q:239:ARG:O	4:Q:870:HOH:O	1.93	0.85
1:P:563:GLN:HE21	1:P:563:GLN:HA	1.40	0.83

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:P:860:HOH:O	4:Q:871:HOH:O[4_446]	2.00	0.20

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	P	662/693 (96%)	633 (96%)	27 (4%)	2 (0%)	41	72
1	Q	662/693 (96%)	633 (96%)	27 (4%)	2 (0%)	41	72
All	All	1324/1386 (96%)	1266 (96%)	54 (4%)	4 (0%)	41	72

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	P	386	PRO
1	Q	386	PRO
1	P	459	GLY
1	Q	459	GLY

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	P	588/613 (96%)	517 (88%)	71 (12%)	5	15
1	Q	588/613 (96%)	515 (88%)	73 (12%)	4	14
All	All	1176/1226 (96%)	1032 (88%)	144 (12%)	5	15

5 of 144 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	Q	424	ASN
1	Q	678	LEU
1	Q	460	ARG
1	Q	536	LEU
1	P	470	ARG

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

Mol	Chain	Res	Type
1	P	478	HIS
1	P	609	GLN
1	Q	284	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 ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
2	0W2	Q	701	-	41,42,42	1.44	4 (9%)	49,62,62	1.08	4 (8%)
2	0W2	P	701	-	41,42,42	1.29	5 (12%)	49,62,62	1.02	4 (8%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	0W2	Q	701	-	-	2/24/65/65	0/7/6/6
2	0W2	P	701	-	-	2/24/65/65	0/7/6/6

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	Q	701	0W2	C26-C21	3.56	1.44	1.39
2	Q	701	0W2	C22-C21	2.93	1.43	1.39
2	P	701	0W2	C22-C21	2.55	1.42	1.39
2	Q	701	0W2	C4-N2	2.52	1.39	1.35
2	P	701	0W2	C26-C21	2.51	1.43	1.39

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	Q	701	0W2	N4-C6-N3	3.68	120.42	115.25
2	P	701	0W2	N4-C6-N3	3.40	120.03	115.25
2	Q	701	0W2	F1-C12-C11	3.31	121.43	118.42
2	Q	701	0W2	O1-C6-N4	-2.88	117.38	122.62
2	P	701	0W2	F1-C12-C11	2.68	120.86	118.42

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	P	701	0W2	C12-C11-N1-C1
2	Q	701	0W2	C12-C11-N1-N2
2	P	701	0W2	C12-C11-N1-N2
2	Q	701	0W2	N2-C4-C5-N3

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	Q	701	0W2	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand 0W2 Q 701

Bond lengths

Bond angles

Torsions

Rings

Ligand 0W2 P 701

Bond lengths

Bond angles

Torsions

Rings

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	P	664/693 (95%)	-0.15	6 (0%)	84	80	20, 32, 61, 85	0
1	Q	664/693 (95%)	-0.13	7 (1%)	80	75	19, 33, 61, 86	0
All	All	1328/1386 (95%)	-0.14	13 (0%)	82	77	19, 32, 61, 86	0

The worst 5 of 13 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	P	350	TYR	3.6
1	Q	132	LEU	3.5
1	Q	535	GLU	2.6
1	Q	528	ASP	2.6
1	Q	524	LYS	2.6

6.2   Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

6.3   Carbohydrates ⓘ
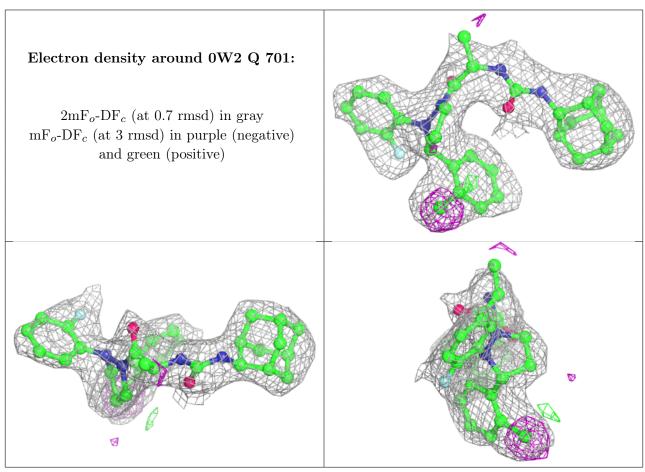
There are no monosaccharides in this entry.

6.4   Ligands ⓘ

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.
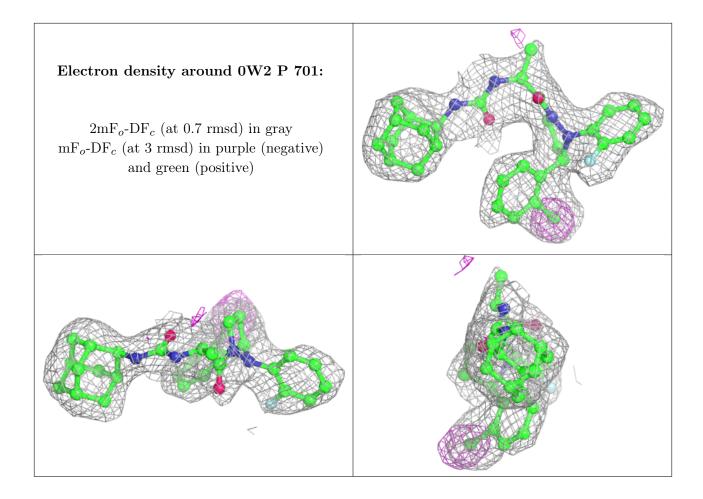
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	0W2	Q	701	37/37	0.92	0.19	11,30,33,37	0
2	0W2	P	701	37/37	0.93	0.18	8,26,30,33	0
3	ZN	P	702	1/1	0.97	0.16	27,27,27,27	0
3	ZN	Q	702	1/1	0.97	0.17	35,35,35,35	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around 0W2 Q 701:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)

Electron density around 0W2 P 701:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

6.5   Other polymers ⓘ

There are no such residues in this entry.