



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 28, 2024 – 06:56 am GMT

PDB ID : 4UZK  
Title : STRUCTURE OF THE WNT DEACYLASE NOTUM FROM DROSOPHILA - CRYSTAL FORM II - 1.9A  
Authors : Zebisch, M.; Jones, E.Y.  
Deposited on : 2014-09-05  
Resolution : 1.90 Å(reported)

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We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

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<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>.

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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  
Mogul : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

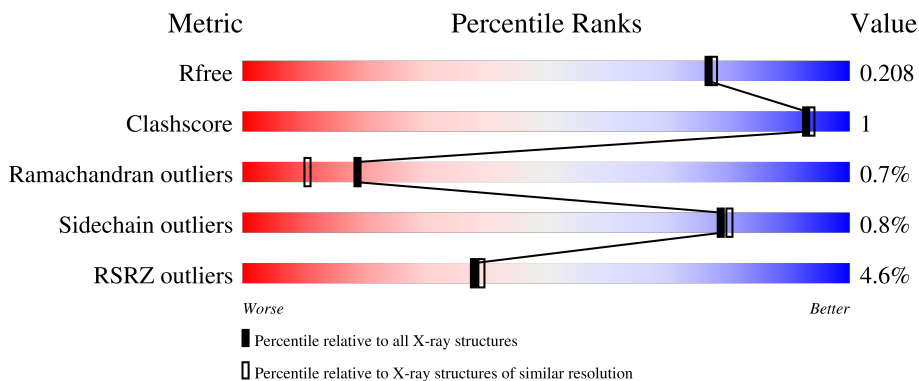
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 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))
$R_{free}$	164625	7293 (1.90-1.90)
Clashscore	180529	8090 (1.90-1.90)
Ramachandran outliers	177936	8022 (1.90-1.90)
Sidechain outliers	177891	8022 (1.90-1.90)
RSRZ outliers	164620	7292 (1.90-1.90)

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	373	 5% 88% 6% 6%
1	B	373	 4% 89% 5% 6%

## 2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 5887 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 NOTUM.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	349	2807	1783	507	497	20	0	5	0
1	B	350	2833	1796	515	502	20	0	6	0

There are 38 discrepancies between the modelled and reference sequences:

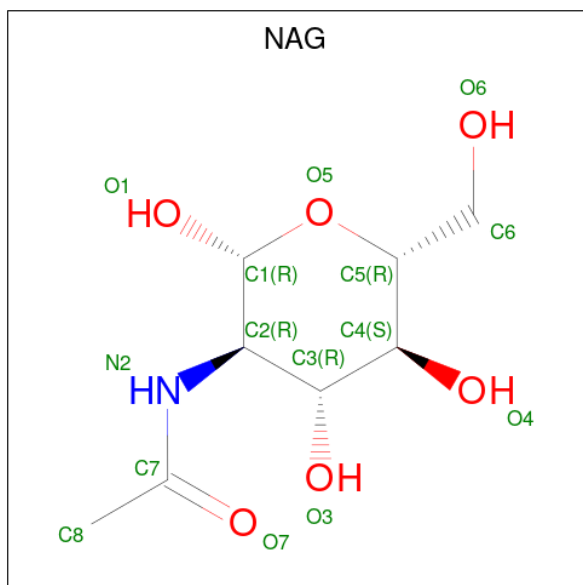
Chain	Residue	Modelled	Actual	Comment	Reference
A	80	GLU	-	expression tag	UNP Q9VUX3
A	81	THR	-	expression tag	UNP Q9VUX3
A	416	GLY	-	linker	UNP Q9VUX3
A	417	ASN	-	linker	UNP Q9VUX3
A	418	ASN	-	linker	UNP Q9VUX3
A	419	ASN	-	linker	UNP Q9VUX3
A	420	GLY	-	linker	UNP Q9VUX3
A	618	GLY	-	expression tag	UNP Q9VUX3
A	619	THR	-	expression tag	UNP Q9VUX3
A	620	HIS	-	expression tag	UNP Q9VUX3
A	621	HIS	-	expression tag	UNP Q9VUX3
A	622	HIS	-	expression tag	UNP Q9VUX3
A	623	HIS	-	expression tag	UNP Q9VUX3
A	624	HIS	-	expression tag	UNP Q9VUX3
A	625	HIS	-	expression tag	UNP Q9VUX3
A	626	HIS	-	expression tag	UNP Q9VUX3
A	627	HIS	-	expression tag	UNP Q9VUX3
A	628	HIS	-	expression tag	UNP Q9VUX3
A	629	HIS	-	expression tag	UNP Q9VUX3
B	80	GLU	-	expression tag	UNP Q9VUX3
B	81	THR	-	expression tag	UNP Q9VUX3
B	416	GLY	-	linker	UNP Q9VUX3
B	417	ASN	-	linker	UNP Q9VUX3
B	418	ASN	-	linker	UNP Q9VUX3
B	419	ASN	-	linker	UNP Q9VUX3

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Chain	Residue	Modelled	Actual	Comment	Reference
B	420	GLY	-	linker	UNP Q9VUX3
B	618	GLY	-	expression tag	UNP Q9VUX3
B	619	THR	-	expression tag	UNP Q9VUX3
B	620	HIS	-	expression tag	UNP Q9VUX3
B	621	HIS	-	expression tag	UNP Q9VUX3
B	622	HIS	-	expression tag	UNP Q9VUX3
B	623	HIS	-	expression tag	UNP Q9VUX3
B	624	HIS	-	expression tag	UNP Q9VUX3
B	625	HIS	-	expression tag	UNP Q9VUX3
B	626	HIS	-	expression tag	UNP Q9VUX3
B	627	HIS	-	expression tag	UNP Q9VUX3
B	628	HIS	-	expression tag	UNP Q9VUX3
B	629	HIS	-	expression tag	UNP Q9VUX3

- Molecule 2 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula:  $C_8H_{15}NO_6$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	14	8	1	5	0	0
2	B	1	14	8	1	5	0	0

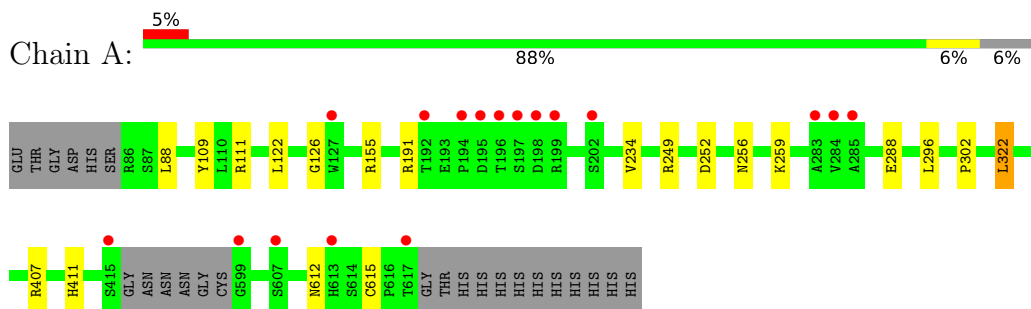
- Molecule 3 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
3	A	110	Total 110	O 110	0	0
3	B	109	Total 109	O 109	0	0

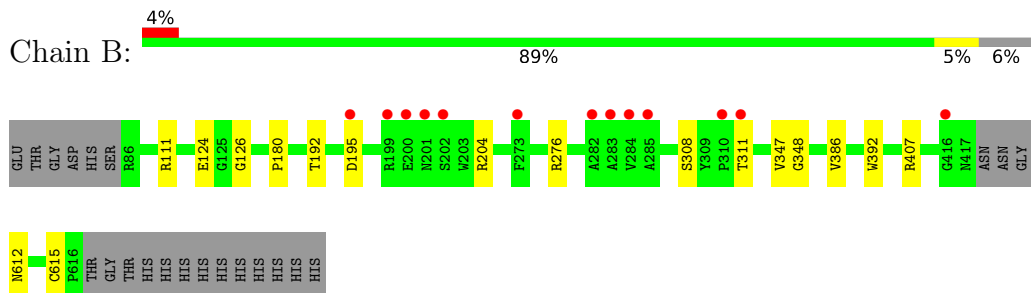
### 3 Residue-property plots [i](#)

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: NOTUM



- Molecule 1: NOTUM



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	59.25Å 93.10Å 142.12Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	77.88 – 1.90 77.88 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.6 (77.88-1.90) 99.6 (77.88-1.90)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.35 (at 1.90Å)	Xtrriage
Refinement program	REFMAC 5.8.0073	Depositor
R, $R_{free}$	0.176 , 0.204 0.185 , 0.208	Depositor DCC
$R_{free}$ test set	1252 reflections (2.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	30.0	Xtrriage
Anisotropy	0.166	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 29.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5887	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 4.20% 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](#)

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

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	0.72	0/2905	0.86	10/3951 (0.3%)
1	B	0.75	0/2934	0.81	2/3987 (0.1%)
All	All	0.73	0/5839	0.84	12/7938 (0.2%)

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	249	ARG	NE-CZ-NH2	-10.93	114.83	120.30
1	A	407	ARG	NE-CZ-NH2	-6.31	117.14	120.30
1	A	249	ARG	CG-CD-NE	-6.31	98.55	111.80
1	A	111	ARG	NE-CZ-NH1	5.92	123.26	120.30
1	A	111	ARG	NE-CZ-NH2	-5.74	117.43	120.30
1	A	155	ARG	NE-CZ-NH1	5.72	123.16	120.30
1	B	407	ARG	NE-CZ-NH2	-5.46	117.57	120.30
1	A	322[A]	LEU	CA-CB-CG	5.43	127.80	115.30
1	A	322[B]	LEU	CA-CB-CG	5.43	127.80	115.30
1	B	111	ARG	NE-CZ-NH1	5.19	122.89	120.30
1	A	322[A]	LEU	CB-CG-CD2	-5.14	102.26	111.00
1	A	322[B]	LEU	CB-CG-CD2	-5.14	102.26	111.00

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	2807	0	2722	10	0
1	B	2833	0	2760	6	0
2	A	14	0	13	0	0
2	B	14	0	13	0	0
3	A	110	0	0	2	0
3	B	109	0	0	0	0
All	All	5887	0	5508	16	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 1.

All (16) 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:347:VAL:HG23	1:B:348:GLY:O	2.00	0.60
1:B:192:THR:O	1:B:204:ARG:NE	2.40	0.55
1:A:322[A]:LEU:HD12	3:A:2081:HOH:O	2.06	0.54
1:A:302:PRO:HG2	1:A:322[A]:LEU:HD13	1.89	0.53
1:A:122:LEU:HD13	1:A:234:VAL:HG23	1.91	0.52
1:B:124[B]:GLU:HG2	1:B:180:PRO:HA	1.92	0.51
1:B:124[B]:GLU:CG	1:B:180:PRO:HA	2.41	0.51
1:A:612:ASN:HB3	1:A:615:CYS:SG	2.51	0.51
1:A:252[A]:ASP:OD1	1:A:256:ASN:ND2	2.45	0.48
1:A:411:HIS:ND1	3:A:2105:HOH:O	2.30	0.47
1:A:288:GLU:OE1	1:A:288:GLU:HA	2.16	0.46
1:B:192:THR:O	1:B:204:ARG:CZ	2.63	0.46
1:A:88:LEU:HB3	1:A:109:TYR:HB3	1.97	0.45
1:A:256:ASN:O	1:A:259:LYS:HD2	2.19	0.42
1:B:612:ASN:HB3	1:B:615:CYS:SG	2.61	0.41
1:A:191:ARG:HD2	1:A:296:LEU: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	350/373 (94%)	342 (98%)	6 (2%)	2 (1%)	22	13
1	B	352/373 (94%)	342 (97%)	7 (2%)	3 (1%)	14	7
All	All	702/746 (94%)	684 (97%)	13 (2%)	5 (1%)	19	11

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	195	ASP
1	A	386	VAL
1	B	386	VAL
1	A	126	GLY
1	B	126	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.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	305/325 (94%)	304 (100%)	1 (0%)	91	92
1	B	310/325 (95%)	306 (99%)	4 (1%)	65	65
All	All	615/650 (95%)	610 (99%)	5 (1%)	79	80

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	392	TRP
1	B	276	ARG
1	B	308	SER
1	B	311	THR
1	B	392	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such

sidechains are listed below:

Mol	Chain	Res	Type
1	B	287	ASN

### 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](#)

2 ligands are modelled in this entry.

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	NAG	A	1618	1	14,14,15	0.54	0	17,19,21	0.96	1 (5%)
2	NAG	B	1617	1	14,14,15	0.69	0	17,19,21	1.40	3 (17%)

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	NAG	A	1618	1	-	0/6/23/26	0/1/1/1
2	NAG	B	1617	1	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1618	NAG	C1-O5-C5	2.82	116.01	112.19
2	B	1617	NAG	O5-C1-C2	-2.69	107.05	111.29
2	B	1617	NAG	C8-C7-N2	2.53	120.39	116.10
2	B	1617	NAG	C3-C4-C5	-2.42	105.93	110.24

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1617	NAG	C8-C7-N2-C2
2	B	1617	NAG	O7-C7-N2-C2

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, 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	349/373 (93%)	0.11	18 (5%) 34 35	17, 33, 59, 102	5 (1%)
1	B	350/373 (93%)	0.11	14 (4%) 43 44	13, 33, 60, 81	6 (1%)
All	All	699/746 (93%)	0.11	32 (4%) 38 39	13, 33, 60, 102	11 (1%)

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	198	ASP	4.7
1	A	196	THR	4.3
1	A	195	ASP	3.7
1	A	284	VAL	3.6
1	B	195	ASP	3.3
1	A	127	TRP	3.1
1	A	617	THR	3.0
1	B	284	VAL	3.0
1	B	282	ALA	2.8
1	B	200	GLU	2.8
1	B	201	ASN	2.7
1	A	415	SER	2.6
1	B	202	SER	2.6
1	A	613	HIS	2.6
1	B	285	ALA	2.6
1	A	283	ALA	2.5
1	B	283	ALA	2.5
1	A	199	ARG	2.5
1	A	192	THR	2.4
1	B	311	THR	2.4
1	A	197	SER	2.3
1	B	273	PHE	2.3
1	B	310	PRO	2.2
1	B	199	ARG	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	202	SER	2.1
1	B	416	GLY	2.1
1	B	606	CYS	2.1
1	A	399	ASP	2.1
1	A	607	SER	2.1
1	A	599	GLY	2.1
1	A	194	PRO	2.0
1	A	285	ALA	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](#)

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
2	NAG	B	1617	14/15	0.76	0.13	44,54,61,64	0
2	NAG	A	1618	14/15	0.88	0.11	49,59,66,66	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.