

University of Groningen

End-on and side-on peroxy derivatives of non-heme iron complexes with pentadentate ligands

Roelfes, Gerard; Vrajmasu, [No Value]; Ho, RYN; Rohde, JU; Zondervan, C; la Crois, RM; Schudde, EP; Lutz, M; Spek, AL; Hage, R

Published in:
Inorganic Chemistry

DOI:
[10.1021/ic034065p](https://doi.org/10.1021/ic034065p)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Final author's version (accepted by publisher, after peer review)

Publication date:
2003

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Roelfes, G., Vrajmasu, . N. V., Ho, R. Y. N., Rohde, J. U., Zondervan, C., la Crois, R. M., ... Feringa, B. (2003). End-on and side-on peroxy derivatives of non-heme iron complexes with pentadentate ligands: Models for putative intermediates in biological iron/dioxygen chemistry. *Inorganic Chemistry*, 42(8), 2639-2653. DOI: [10.1021/ic034065p](https://doi.org/10.1021/ic034065p)

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

data_global

_publ_contact_author_name 'Martin Lutz'
_publ_contact_author_address
; Bijvoet Center for Biomolecular Research
Dep. Crystal and Structural Chemistry
Utrecht University
Padualaan 8
3584 CH Utrecht
The Netherlands
;
_publ_contact_author_email 'm.lutz@chem.uu.nl'
_publ_contact_author_fax '[+31] 30 2533940'
_publ_contact_author_phone '[+31] 30 2533902'

_publ_section_title
;
Peroxo Derivatives of Non-Heme Iron Complexes with Pentadentate Ligands
;

loop_
_publ_author_name
_publ_author_address
'Roelfes, Gerard'
; Department of Organic and Molecular Inorganic Chemistry
Stratingh Institute
University of Groningen
Nijenborgh 4
9747 AG Groningen
The Netherlands
;
'Viramisu, Vlad'
; Department of Chemistry
Carnegie Mellon University
Pittsburgh, Pennsylvania
USA
;
'Chen, Kui'
; Department of Chemistry and Center for Metals in Biocatalysis
University of Minnesota
Minneapolis, Minnesota 55455
USA
;
'Ho, Raymond Y.N.'
; Department of Chemistry and Center for Metals in Biocatalysis
University of Minnesota
Minneapolis, Minnesota 55455
USA
;
'Rohde, Jan-Uwe'
; Department of Chemistry and Center for Metals in Biocatalysis
University of Minnesota
Minneapolis, Minnesota 55455
USA
;
'Zondervan, Charon'
; Department of Organic and Molecular Inorganic Chemistry
Stratingh Institute
University of Groningen
Nijenborgh 4
9747 AG Groningen
The Netherlands
;
'La Crois, Rene M.'
; Department of Organic and Molecular Inorganic Chemistry

Stratingh Institute
University of Groningen
Nijenborgh 4
9747 AG Groningen
The Netherlands

; 'Schudde, Ebe P.'

; Department of Organic and Molecular Inorganic Chemistry
Stratingh Institute
University of Groningen
Nijenborgh 4
9747 AG Groningen
The Netherlands

; 'Lutz, Martin'

; Bijvoet Center for Biomolecular Research
Dep. Crystal and Structural Chemistry
Utrecht University
Padualaan 8
3584 CH Utrecht
The Netherlands

; 'Spek, Anthony L.'

; Bijvoet Center for Biomolecular Research
Dep. Crystal and Structural Chemistry
Utrecht University
Padualaan 8
3584 CH Utrecht
The Netherlands

; 'Hage, Ronald'

; Unilever Research and Development Vlaardingen
Olivier van Noortlaan 120,
3133AT Vlaardingen
The Netherlands

; 'Feringa, Ben L.'

; Department of Organic and Molecular Inorganic Chemistry
Stratingh Institute
University of Groningen
Nijenborgh 4
9747 AG Groningen
The Netherlands

; 'M\"unck, Eckard'

; Department of Chemistry
Carnegie Mellon University
Pittsburgh, Pennsylvania
USA

; 'Que Jr., Lawrence'

; Department of Chemistry and Center for Metals in Biocatalysis
University of Minnesota
Minneapolis, Minnesota 55455
USA

;

data_s1957a

_audit_creation_method SHELXL-97
_chemical_name_systematic
;
?
;
_chemical_name_common ?

`_chemical_melting_point` ?
`_chemical_formula_moiety` 'C21 H30 Fe N6, 2(Cl O4)'
`_chemical_formula_sum` 'C21 H30 Cl2 Fe N6 O8'
`_chemical_formula_weight` 621.26

`loop_`
`_atom_type_symbol`
`_atom_type_description`
`_atom_type_scat_dispersion_real`
`_atom_type_scat_dispersion_imag`
`_atom_type_scat_source`
 'C' 'C' 0.0033 0.0016
 'International Tables Vol C Tables 4.2.6.8 and 6.1.1.4'
 'H' 'H' 0.0000 0.0000
 'International Tables Vol C Tables 4.2.6.8 and 6.1.1.4'
 'Cl' 'Cl' 0.1484 0.1585
 'International Tables Vol C Tables 4.2.6.8 and 6.1.1.4'
 'Fe' 'Fe' 0.3463 0.8444
 'International Tables Vol C Tables 4.2.6.8 and 6.1.1.4'
 'N' 'N' 0.0061 0.0033
 'International Tables Vol C Tables 4.2.6.8 and 6.1.1.4'
 'O' 'O' 0.0106 0.0060
 'International Tables Vol C Tables 4.2.6.8 and 6.1.1.4'

`_symmetry_cell_setting` monoclinic
`_symmetry_space_group_name_H-M` 'P 21/c'
`_symmetry_space_group_name_Hall` '-P 2ybc'

`loop_`
`_symmetry_equiv_pos_as_xyz`
 'x, y, z'
 '-x, y+1/2, -z+1/2'
 '-x, -y, -z'
 'x, -y-1/2, z-1/2'

`_cell_length_a` 7.8890(10)
`_cell_length_b` 16.876(3)
`_cell_length_c` 20.467(2)
`_cell_angle_alpha` 90.00
`_cell_angle_beta` 102.450(9)
`_cell_angle_gamma` 90.00
`_cell_volume` 2660.8(6)
`_cell_formula_units_Z` 4
`_cell_measurement_temperature` 150(2)
`_cell_measurement_reflns_used` 25
`_cell_measurement_theta_min` 11.45
`_cell_measurement_theta_max` 13.99

`_exptl_crystal_description` block
`_exptl_crystal_colour` red
`_exptl_crystal_size_max` 0.50
`_exptl_crystal_size_mid` 0.33
`_exptl_crystal_size_min` 0.18
`_exptl_crystal_density_meas` ?
`_exptl_crystal_density_diffrrn` 1.551
`_exptl_crystal_density_method` 'not measured'
`_exptl_crystal_F_000` 1288
`_exptl_absorpt_coefficient_mu` 0.824
`_exptl_absorpt_correction_type` empirical
`_exptl_absorpt_correction_T_min` 0.85
`_exptl_absorpt_correction_T_max` 0.96
`_exptl_absorpt_process_details` ?

`_exptl_special_details`

```

;
?
;

_diffrn_ambient_temperature      150(2)
_diffrn_radiation_wavelength    0.71073
_diffrn_radiation_type          MoK\alpha
_diffrn_radiation_source        'rotating anode'
_diffrn_radiation_monochromator graphite
_diffrn_measurement_device_type 'Enraf-Nonius CAD4T'
_diffrn_measurement_method      '\w/2\q'
_diffrn_detector_area_resol_mean ?
_diffrn_standards_number        3
_diffrn_standards_interval_count ?
_diffrn_standards_interval_time 60
_diffrn_standards_decay_%       2
_diffrn_reflns_number           6203
_diffrn_reflns_av_R_equivalents 0.0428
_diffrn_reflns_av_sigmaI/netI   0.0825
_diffrn_reflns_limit_h_min      -9
_diffrn_reflns_limit_h_max      2
_diffrn_reflns_limit_k_min      -20
_diffrn_reflns_limit_k_max      0
_diffrn_reflns_limit_l_min      -24
_diffrn_reflns_limit_l_max      24
_diffrn_reflns_theta_min        1.58
_diffrn_reflns_theta_max        25.00
_reflns_number_total            4689
_reflns_number_gt               3110
_reflns_threshold_expression   'I>2\s(I)'

_computing_data_collection      ?
_computing_cell_refinement      ?
_computing_data_reduction       ?
_computing_structure_solution   'SIR-97 (Altomare et al., 1997)'
_computing_structure_refinement 'SHELXL-97 (Sheldrick, 1997)'
_computing_molecular_graphics   ?
_computing_publication_material ?

_refine_special_details
;
Refinement of F^2^ against ALL reflections. The weighted R-factor wR and
goodness of fit S are based on F^2^, conventional R-factors R are based
on F, with F set to zero for negative F^2^. The threshold expression of
F^2^ > 2sigma(F^2^) is used only for calculating R-factors(gt) etc. and is
not relevant to the choice of reflections for refinement. R-factors based
on F^2^ are statistically about twice as large as those based on F, and R-
factors based on ALL data will be even larger.
;

_refine_ls_structure_factor_coef  Fsqd
_refine_ls_matrix_type            fullcycle
_refine_ls_weighting_scheme       calc
_refine_ls_weighting_details      'calc w=1/[s^2^(Fo^2^)+(0.0558P)^2^+8.3977P] where P=(Fo^2^+2Fc^2^)/3'
_atom_sites_solution_primary      direct
_atom_sites_solution_secondary    difmap
_atom_sites_solution_hydrogens   difmap
_refine_ls_hydrogen_treatment     constraint
_refine_ls_extinction_method     none
_refine_ls_extinction_coeff      ?
_refine_ls_number_reflns          4689
_refine_ls_number_parameters      370
_refine_ls_number_restraints      121
_refine_ls_R_factor_all           0.1087
_refine_ls_R_factor_gt            0.0627

```

_refine_ls_wR_factor_ref	0.1576
_refine_ls_wR_factor_gt	0.1339
_refine_ls_goodness_of_fit_ref	1.014
_refine_ls_restrained_S_all	1.092
_refine_ls_shift/su_max	0.100
_refine_ls_shift/su_mean	0.003
loop_	
_atom_site_label	
_atom_site_type_symbol	
_atom_site_fract_x	
_atom_site_fract_y	
_atom_site_fract_z	
_atom_site_U_iso_or_equiv	
_atom_site_adp_type	
_atom_site_occupancy	
_atom_site_symmetry_multiplicity	
_atom_site_calc_flag	
_atom_site_refinement_flags	
_atom_site_disorder_assembly	
_atom_site_disorder_group	
O3A O 1.0683(8) 0.1465(5) 0.1468(4) 0.059(2) Uani 0.65 1 d PDU . .	
O4A O 0.8466(12) 0.0700(5) 0.1649(4) 0.063(2) Uani 0.65 1 d PDU . .	
O8A O 0.2622(15) 0.5203(6) 0.0572(5) 0.099(4) Uani 0.65 1 d PDU . .	
Fe1 Fe 0.34504(10) 0.25690(5) 0.39198(4) 0.0200(2) Uani 1 1 d . . .	
N1 N 0.1713(6) 0.3094(3) 0.3218(2) 0.0222(10) Uani 1 1 d . . .	
N2 N 0.4442(6) 0.2214(3) 0.3166(2) 0.0217(10) Uani 1 1 d . . .	
N3 N 0.4780(6) 0.3538(3) 0.3859(2) 0.0217(10) Uani 1 1 d . . .	
N4 N 0.1746(6) 0.1640(3) 0.3826(2) 0.0254(11) Uani 1 1 d . . .	
N5 N 0.2076(6) 0.3022(3) 0.4573(2) 0.0264(11) Uani 1 1 d . . .	
N6 N 0.5182(6) 0.2079(3) 0.4605(2) 0.0262(11) Uani 1 1 d . . .	
C1 C 0.5522(7) 0.1615(3) 0.3104(3) 0.0267(13) Uani 1 1 d . . .	
H1 H 0.5940 0.1285 0.3480 0.032 Uiso 1 1 calc R . .	
C2 C 0.6043(7) 0.1464(4) 0.2520(3) 0.0287(14) Uani 1 1 d . . .	
H2 H 0.6827 0.1042 0.2498 0.034 Uiso 1 1 calc R . .	
C3 C 0.5430(8) 0.1921(4) 0.1971(3) 0.0345(15) Uani 1 1 d . . .	
H3 H 0.5752 0.1810 0.1559 0.041 Uiso 1 1 calc R . .	
C4 C 0.4331(8) 0.2551(4) 0.2019(3) 0.0320(14) Uani 1 1 d . . .	
H4 H 0.3897 0.2881 0.1645 0.038 Uiso 1 1 calc R . .	
C5 C 0.3888(7) 0.2684(3) 0.2622(3) 0.0228(12) Uani 1 1 d . . .	
C6 C 0.2899(7) 0.3394(3) 0.2793(3) 0.0221(12) Uani 1 1 d . . .	
H6 H 0.2281 0.3694 0.2391 0.026 Uiso 1 1 calc R . .	
C7 C 0.4272(7) 0.3875(3) 0.3249(3) 0.0208(12) Uani 1 1 d . . .	
C8 C 0.5045(8) 0.4543(3) 0.3057(3) 0.0304(14) Uani 1 1 d . . .	
H8 H 0.4670 0.4758 0.2621 0.036 Uiso 1 1 calc R . .	
C9 C 0.6383(8) 0.4893(4) 0.3517(3) 0.0362(16) Uani 1 1 d . . .	
H9 H 0.6936 0.5358 0.3403 0.043 Uiso 1 1 calc R . .	
C10 C 0.6902(8) 0.4559(4) 0.4143(3) 0.0328(15) Uani 1 1 d . . .	
H10 H 0.7816 0.4791 0.4465 0.039 Uiso 1 1 calc R . .	
C11 C 0.6085(7) 0.3889(4) 0.4297(3) 0.0254(13) Uani 1 1 d . . .	
H11 H 0.6455 0.3662 0.4729 0.030 Uiso 1 1 calc R . .	
C12 C 0.0398(8) 0.2504(4) 0.2871(3) 0.0338(14) Uani 1 1 d . . .	
H12A H -0.0772 0.2669 0.2920 0.041 Uiso 1 1 calc R . .	
H12B H 0.0400 0.2499 0.2387 0.041 Uiso 1 1 calc R . .	
C13 C 0.0754(12) 0.1704(4) 0.3140(4) 0.063(3) Uani 1 1 d . . .	
H13A H -0.0370 0.1431 0.3112 0.075 Uiso 1 1 calc R . .	
H13B H 0.1388 0.1413 0.2847 0.075 Uiso 1 1 calc R . .	
C14 C 0.0630(10) 0.1746(4) 0.4320(4) 0.052(2) Uani 1 1 d . . .	
H14A H -0.0555 0.1891 0.4076 0.062 Uiso 1 1 calc R . .	
H14B H 0.0549 0.1233 0.4546 0.062 Uiso 1 1 calc R . .	
C15 C 0.1241(11) 0.2338(5) 0.4818(4) 0.062(2) Uani 1 1 d . . .	
H15A H 0.2083 0.2090 0.5191 0.075 Uiso 1 1 calc R . .	
H15B H 0.0248 0.2529 0.4999 0.075 Uiso 1 1 calc R . .	
C16 C 0.0699(13) 0.3556(5) 0.4201(4) 0.067(3) Uani 1 1 d . . .	
H16A H -0.0444 0.3300 0.4174 0.080 Uiso 1 1 calc R . .	
H16B H 0.0709 0.4053 0.4458 0.080 Uiso 1 1 calc R . .	

C17 C 0.0879(8) 0.3753(4) 0.3522(3) 0.0329(15) Uani 1 1 d . . .
 H17A H 0.1589 0.4239 0.3536 0.039 Uiso 1 1 calc R . .
 H17B H -0.0282 0.3863 0.3239 0.039 Uiso 1 1 calc R . .
 C18 C 0.2529(10) 0.0840(4) 0.3929(4) 0.054(2) Uani 1 1 d . . .
 H18A H 0.3618 0.0832 0.3772 0.082 Uiso 1 1 calc R . .
 H18B H 0.1724 0.0451 0.3678 0.082 Uiso 1 1 calc R . .
 H18C H 0.2765 0.0709 0.4407 0.082 Uiso 1 1 calc R . .
 C19 C 0.3106(10) 0.3439(5) 0.5162(3) 0.059(2) Uani 1 1 d . . .
 H19A H 0.2340 0.3610 0.5454 0.089 Uiso 1 1 calc R . .
 H19B H 0.3669 0.3903 0.5014 0.089 Uiso 1 1 calc R . .
 H19C H 0.3994 0.3080 0.5410 0.089 Uiso 1 1 calc R . .
 C20 C 0.6156(8) 0.1766(4) 0.5024(3) 0.0272(13) Uani 1 1 d . . .
 C21 C 0.7330(9) 0.1371(4) 0.5575(3) 0.0403(17) Uani 1 1 d . . .
 H21A H 0.8290 0.1728 0.5764 0.060 Uiso 1 1 calc R . .
 H21B H 0.7791 0.0890 0.5410 0.060 Uiso 1 1 calc R . .
 H21C H 0.6699 0.1230 0.5921 0.060 Uiso 1 1 calc R . .
 C11 Cl 0.9029(2) 0.10893(9) 0.11271(7) 0.0353(4) Uani 1 1 d D . .
 O1 O 0.9548(6) 0.0613(3) 0.0634(2) 0.0438(12) Uani 1 1 d DU . .
 O2 O 0.8112(8) 0.1770(3) 0.0861(3) 0.0667(17) Uani 1 1 d DU . .
 C12 Cl 0.2487(2) 0.46441(9) 0.10721(8) 0.0368(4) Uani 1 1 d D . .
 O5 O 0.1879(8) 0.5038(3) 0.1591(3) 0.0712(18) Uani 1 1 d DU . .
 O6 O 0.1684(10) 0.3903(4) 0.0968(4) 0.114(3) Uani 1 1 d DU . .
 O7 O 0.4286(7) 0.4487(5) 0.1343(4) 0.111(3) Uani 1 1 d DU . .
 O3B O 0.984(2) 0.0916(10) 0.1787(4) 0.068(5) Uani 0.35 1 d PDU . .
 O4B O 0.7369(12) 0.0677(7) 0.1082(8) 0.056(4) Uani 0.35 1 d PDU . .
 O8B O 0.136(2) 0.4908(11) 0.0467(5) 0.093(7) Uani 0.35 1 d PDU . .

loop_

_atom_site_aniso_label
 _atom_site_aniso_U_11
 _atom_site_aniso_U_22
 _atom_site_aniso_U_33
 _atom_site_aniso_U_23
 _atom_site_aniso_U_13
 _atom_site_aniso_U_12
 O3A 0.038(4) 0.082(6) 0.051(5) -0.036(4) -0.006(4) -0.006(4)
 O4A 0.088(7) 0.051(5) 0.064(5) 0.018(4) 0.050(5) 0.024(5)
 O8A 0.117(9) 0.108(9) 0.072(7) 0.054(6) 0.025(6) -0.012(7)
 Fe1 0.0141(4) 0.0227(4) 0.0233(4) 0.0025(4) 0.0042(3) 0.0017(4)
 N1 0.017(2) 0.020(2) 0.028(3) -0.001(2) 0.001(2) 0.001(2)
 N2 0.015(2) 0.021(2) 0.028(3) 0.001(2) 0.003(2) 0.0009(19)
 N3 0.013(2) 0.027(3) 0.024(2) -0.002(2) 0.003(2) 0.002(2)
 N4 0.021(3) 0.023(3) 0.033(3) -0.001(2) 0.008(2) 0.000(2)
 N5 0.023(3) 0.029(3) 0.029(3) -0.005(2) 0.011(2) -0.001(2)
 N6 0.020(3) 0.028(3) 0.031(3) 0.006(2) 0.007(2) 0.002(2)
 C1 0.021(3) 0.019(3) 0.040(4) 0.002(3) 0.007(3) -0.002(2)
 C2 0.018(3) 0.027(3) 0.043(4) -0.010(3) 0.011(3) 0.005(3)
 C3 0.028(3) 0.047(4) 0.030(3) -0.010(3) 0.008(3) 0.003(3)
 C4 0.030(3) 0.046(4) 0.018(3) 0.004(3) 0.002(2) 0.007(3)
 C5 0.016(3) 0.026(3) 0.025(3) 0.001(2) 0.000(2) -0.001(2)
 C6 0.021(3) 0.022(3) 0.021(3) 0.004(2) 0.000(2) 0.002(2)
 C7 0.014(3) 0.020(3) 0.027(3) 0.000(2) 0.001(2) 0.004(2)
 C8 0.025(3) 0.025(3) 0.038(3) 0.004(3) 0.000(3) 0.003(3)
 C9 0.025(3) 0.022(3) 0.061(5) 0.009(3) 0.009(3) -0.001(3)
 C10 0.016(3) 0.034(4) 0.047(4) -0.007(3) 0.002(3) 0.000(3)
 C11 0.015(3) 0.033(3) 0.028(3) -0.003(3) 0.004(2) -0.002(3)
 C12 0.023(3) 0.030(3) 0.043(4) 0.001(3) -0.005(3) -0.004(3)
 C13 0.082(6) 0.039(4) 0.048(4) 0.006(4) -0.025(4) -0.030(4)
 C14 0.059(5) 0.049(5) 0.062(5) -0.008(4) 0.043(4) -0.024(4)
 C15 0.072(6) 0.060(5) 0.073(5) -0.017(4) 0.054(5) -0.023(5)
 C16 0.097(7) 0.059(5) 0.044(4) -0.002(4) 0.015(5) 0.050(5)
 C17 0.022(3) 0.034(4) 0.043(4) 0.000(3) 0.007(3) 0.015(3)
 C18 0.040(4) 0.023(4) 0.105(7) 0.003(4) 0.026(4) -0.001(3)
 C19 0.042(4) 0.100(7) 0.037(4) -0.038(4) 0.010(4) -0.015(5)
 C20 0.021(3) 0.030(3) 0.033(3) 0.005(3) 0.011(3) -0.002(3)
 C21 0.037(4) 0.039(4) 0.040(4) 0.010(3) -0.001(3) 0.006(3)

```

C11 0.0420(9) 0.0375(9) 0.0317(8) 0.0047(7) 0.0197(7) 0.0172(8)
O1 0.045(3) 0.053(3) 0.035(2) -0.011(2) 0.013(2) 0.017(2)
O2 0.096(5) 0.046(3) 0.059(3) 0.007(3) 0.020(3) 0.035(3)
C12 0.0465(10) 0.0292(8) 0.0343(8) -0.0001(7) 0.0075(7) 0.0022(7)
O5 0.074(4) 0.073(4) 0.067(4) -0.025(3) 0.014(3) 0.018(3)
O6 0.117(6) 0.063(4) 0.145(7) -0.047(5) -0.009(5) -0.031(4)
O7 0.056(4) 0.107(6) 0.185(8) 0.031(6) 0.056(5) 0.019(4)
O3B 0.064(11) 0.092(13) 0.041(8) -0.011(8) -0.003(8) 0.016(10)
O4B 0.051(9) 0.035(8) 0.099(12) 0.009(8) 0.055(9) 0.010(7)
O8B 0.162(19) 0.083(13) 0.036(8) 0.029(9) 0.030(11) 0.061(13)

_geom_special_details
;
All esds (except the esd in the dihedral angle between two l.s. planes)
are estimated using the full covariance matrix. The cell esds are taken
into account individually in the estimation of esds in distances, angles
and torsion angles; correlations between esds in cell parameters are only
used when they are defined by crystal symmetry. An approximate
(isotropic)
treatment of cell esds is used for estimating esds involving l.s. planes.
;

loop_
_geom_bond_atom_site_label_1
_geom_bond_atom_site_label_2
_geom_bond_distance
_geom_bond_site_symmetry_2
_geom_bond_publ_flag
O3A O3B 1.383(17) . ?
O3A C11 1.482(6) . ?
O4A O3B 1.121(17) . ?
O4A O4B 1.289(15) . ?
O4A C11 1.405(6) . ?
O8A O8B 1.09(2) . ?
O8A C12 1.412(6) . ?
Fe1 N6 1.921(5) . ?
Fe1 N3 1.962(5) . ?
Fe1 N2 1.968(5) . ?
Fe1 N1 1.970(5) . ?
Fe1 N5 2.043(5) . ?
Fe1 N4 2.047(5) . ?
N1 C17 1.494(7) . ?
N1 C6 1.496(7) . ?
N1 C12 1.502(7) . ?
N2 C1 1.345(7) . ?
N2 C5 1.359(7) . ?
N3 C11 1.346(7) . ?
N3 C7 1.353(7) . ?
N4 C13 1.456(8) . ?
N4 C18 1.481(8) . ?
N4 C14 1.488(8) . ?
N5 C15 1.471(8) . ?
N5 C19 1.479(8) . ?
N5 C16 1.488(9) . ?
N6 C20 1.149(7) . ?
C1 C2 1.370(8) . ?
C1 H1 0.9500 . ?
C2 C3 1.364(9) . ?
C2 H2 0.9500 . ?
C3 C4 1.389(9) . ?
C3 H3 0.9500 . ?
C4 C5 1.371(8) . ?
C4 H4 0.9500 . ?
C5 C6 1.512(8) . ?
C6 C7 1.506(7) . ?
C6 H6 1.0000 . ?

```

C7 C8 1.377(8) . ?
C8 C9 1.386(9) . ?
C8 H8 0.9500 . ?
C9 C10 1.379(9) . ?
C9 H9 0.9500 . ?
C10 C11 1.372(8) . ?
C10 H10 0.9500 . ?
C11 H11 0.9500 . ?
C12 C13 1.462(9) . ?
C12 H12A 0.9900 . ?
C12 H12B 0.9900 . ?
C13 H13A 0.9900 . ?
C13 H13B 0.9900 . ?
C14 C15 1.436(10) . ?
C14 H14A 0.9900 . ?
C14 H14B 0.9900 . ?
C15 H15A 0.9900 . ?
C15 H15B 0.9900 . ?
C16 C17 1.465(10) . ?
C16 H16A 0.9900 . ?
C16 H16B 0.9900 . ?
C17 H17A 0.9900 . ?
C17 H17B 0.9900 . ?
C18 H18A 0.9800 . ?
C18 H18B 0.9800 . ?
C18 H18C 0.9800 . ?
C19 H19A 0.9800 . ?
C19 H19B 0.9800 . ?
C19 H19C 0.9800 . ?
C20 C21 1.457(8) . ?
C21 H21A 0.9800 . ?
C21 H21B 0.9800 . ?
C21 H21C 0.9800 . ?
C11 O3B 1.395(7) . ?
C11 O2 1.403(4) . ?
C11 O1 1.419(4) . ?
C11 O4B 1.468(7) . ?
C12 O6 1.398(5) . ?
C12 O5 1.422(5) . ?
C12 O8B 1.430(8) . ?
C12 O7 1.432(5) . ?

loop_
_geom_angle_atom_site_label_1
_geom_angle_atom_site_label_2
_geom_angle_atom_site_label_3
_geom_angle
_geom_angle_site_symmetry_1
_geom_angle_site_symmetry_3
_geom_angle_publ_flag
O3B O3A C11 58.2(4) . . ?
O3B O4A O4B 131.4(7) . . ?
O3B O4A C11 65.9(5) . . ?
O4B O4A C11 65.9(4) . . ?
O8B O8A C12 68.3(5) . . ?
N6 Fe1 N3 95.70(19) . . ?
N6 Fe1 N2 95.78(19) . . ?
N3 Fe1 N2 84.03(18) . . ?
N6 Fe1 N1 178.6(2) . . ?
N3 Fe1 N1 82.90(19) . . ?
N2 Fe1 N1 84.07(19) . . ?
N6 Fe1 N5 94.5(2) . . ?
N3 Fe1 N5 95.48(19) . . ?
N2 Fe1 N5 169.71(19) . . ?
N1 Fe1 N5 85.67(19) . . ?
N6 Fe1 N4 95.1(2) . . ?

N3 Fe1 N4 169.11(19) . . ?
N2 Fe1 N4 93.27(19) . . ?
N1 Fe1 N4 86.33(19) . . ?
N5 Fe1 N4 85.28(19) . . ?
C17 N1 C6 112.1(4) . . ?
C17 N1 C12 111.7(5) . . ?
C6 N1 C12 113.8(4) . . ?
C17 N1 Fe1 109.3(3) . . ?
C6 N1 Fe1 98.7(3) . . ?
C12 N1 Fe1 110.3(3) . . ?
C1 N2 C5 117.4(5) . . ?
C1 N2 Fe1 132.0(4) . . ?
C5 N2 Fe1 110.6(4) . . ?
C11 N3 C7 117.5(5) . . ?
C11 N3 Fe1 131.8(4) . . ?
C7 N3 Fe1 110.7(4) . . ?
C13 N4 C18 109.0(6) . . ?
C13 N4 C14 111.9(6) . . ?
C18 N4 C14 107.5(5) . . ?
C13 N4 Fe1 103.9(4) . . ?
C18 N4 Fe1 116.1(4) . . ?
C14 N4 Fe1 108.5(4) . . ?
C15 N5 C19 107.6(6) . . ?
C15 N5 C16 108.6(6) . . ?
C19 N5 C16 110.0(6) . . ?
C15 N5 Fe1 105.6(4) . . ?
C19 N5 Fe1 115.8(4) . . ?
C16 N5 Fe1 108.9(4) . . ?
C20 N6 Fe1 176.7(5) . . ?
N2 C1 C2 122.5(6) . . ?
N2 C1 H1 118.7 . . ?
C2 C1 H1 118.7 . . ?
C3 C2 C1 119.6(5) . . ?
C3 C2 H2 120.2 . . ?
C1 C2 H2 120.2 . . ?
C2 C3 C4 119.4(6) . . ?
C2 C3 H3 120.3 . . ?
C4 C3 H3 120.3 . . ?
C5 C4 C3 118.3(5) . . ?
C5 C4 H4 120.9 . . ?
C3 C4 H4 120.9 . . ?
N2 C5 C4 122.8(5) . . ?
N2 C5 C6 111.3(5) . . ?
C4 C5 C6 125.6(5) . . ?
N1 C6 C7 106.3(4) . . ?
N1 C6 C5 106.5(4) . . ?
C7 C6 C5 103.5(4) . . ?
N1 C6 H6 113.3 . . ?
C7 C6 H6 113.3 . . ?
C5 C6 H6 113.3 . . ?
N3 C7 C8 123.1(5) . . ?
N3 C7 C6 112.0(5) . . ?
C8 C7 C6 124.7(5) . . ?
C7 C8 C9 118.3(6) . . ?
C7 C8 H8 120.8 . . ?
C9 C8 H8 120.8 . . ?
C10 C9 C8 119.1(6) . . ?
C10 C9 H9 120.4 . . ?
C8 C9 H9 120.4 . . ?
C11 C10 C9 119.3(6) . . ?
C11 C10 H10 120.3 . . ?
C9 C10 H10 120.3 . . ?
N3 C11 C10 122.7(6) . . ?
N3 C11 H11 118.7 . . ?
C10 C11 H11 118.7 . . ?
C13 C12 N1 112.2(5) . . ?

C13 C12 H12A 109.2 . . ?
N1 C12 H12A 109.2 . . ?
C13 C12 H12B 109.2 . . ?
N1 C12 H12B 109.2 . . ?
H12A C12 H12B 107.9 . . ?
N4 C13 C12 116.8(6) . . ?
N4 C13 H13A 108.1 . . ?
C12 C13 H13A 108.1 . . ?
N4 C13 H13B 108.1 . . ?
C12 C13 H13B 108.1 . . ?
H13A C13 H13B 107.3 . . ?
C15 C14 N4 114.1(6) . . ?
C15 C14 H14A 108.7 . . ?
N4 C14 H14A 108.7 . . ?
C15 C14 H14B 108.7 . . ?
N4 C14 H14B 108.7 . . ?
H14A C14 H14B 107.6 . . ?
C14 C15 N5 114.2(6) . . ?
C14 C15 H15A 108.7 . . ?
N5 C15 H15A 108.7 . . ?
C14 C15 H15B 108.7 . . ?
N5 C15 H15B 108.7 . . ?
H15A C15 H15B 107.6 . . ?
C17 C16 N5 114.4(6) . . ?
C17 C16 H16A 108.7 . . ?
N5 C16 H16A 108.7 . . ?
C17 C16 H16B 108.7 . . ?
N5 C16 H16B 108.7 . . ?
H16A C16 H16B 107.6 . . ?
C16 C17 N1 111.6(5) . . ?
C16 C17 H17A 109.3 . . ?
N1 C17 H17A 109.3 . . ?
C16 C17 H17B 109.3 . . ?
N1 C17 H17B 109.3 . . ?
H17A C17 H17B 108.0 . . ?
N4 C18 H18A 109.5 . . ?
N4 C18 H18B 109.5 . . ?
H18A C18 H18B 109.5 . . ?
N4 C18 H18C 109.5 . . ?
H18A C18 H18C 109.5 . . ?
H18B C18 H18C 109.5 . . ?
N5 C19 H19A 109.5 . . ?
N5 C19 H19B 109.5 . . ?
H19A C19 H19B 109.5 . . ?
N5 C19 H19C 109.5 . . ?
H19A C19 H19C 109.5 . . ?
H19B C19 H19C 109.5 . . ?
N6 C20 C21 177.3(6) . . ?
C20 C21 H21A 109.5 . . ?
C20 C21 H21B 109.5 . . ?
H21A C21 H21B 109.5 . . ?
C20 C21 H21C 109.5 . . ?
H21A C21 H21C 109.5 . . ?
H21B C21 H21C 109.5 . . ?
O3B C11 O2 129.7(7) . . ?
O2 C11 O4A 117.2(4) . . ?
O3B C11 O1 115.3(7) . . ?
O2 C11 O1 113.0(3) . . ?
O4A C11 O1 117.6(4) . . ?
O3B C11 O4B 100.3(10) . . ?
O2 C11 O4B 89.1(6) . . ?
O1 C11 O4B 94.4(6) . . ?
O2 C11 O3A 99.3(4) . . ?
O4A C11 O3A 103.5(5) . . ?
O1 C11 O3A 102.5(4) . . ?
O6 C12 O8A 126.1(6) . . ?

O6 C12 O5 108.6(5) . . . ?
 O8A C12 O5 108.6(6) . . . ?
 O6 C12 O8B 88.3(9) . . . ?
 O5 C12 O8B 104.8(7) . . . ?
 O6 C12 O7 105.8(5) . . . ?
 O8A C12 O7 100.5(6) . . . ?
 O5 C12 O7 105.2(4) . . . ?
 O8B C12 O7 140.4(9) . . . ?
 O4A O3B O3A 129.5(7) . . . ?
 O4A O3B C11 66.8(5) . . . ?
 O3A O3B C11 64.5(5) . . . ?
 O4A O4B C11 60.9(4) . . . ?
 O8A O8B C12 66.6(6) . . . ?

loop_
 _geom_torsion_atom_site_label_1
 _geom_torsion_atom_site_label_2
 _geom_torsion_atom_site_label_3
 _geom_torsion_atom_site_label_4
 _geom_torsion
 _geom_torsion_site_symmetry_1
 _geom_torsion_site_symmetry_2
 _geom_torsion_site_symmetry_3
 _geom_torsion_site_symmetry_4
 _geom_torsion_publ_flag

N3 Fe1 N1 C17 -73.6(4) ?
 N2 Fe1 N1 C17 -158.3(4) ?
 N5 Fe1 N1 C17 22.4(4) ?
 N4 Fe1 N1 C17 108.0(4) ?
 N3 Fe1 N1 C6 43.6(3) ?
 N2 Fe1 N1 C6 -41.1(3) ?
 N5 Fe1 N1 C6 139.7(3) ?
 N4 Fe1 N1 C6 -134.8(3) ?
 N3 Fe1 N1 C12 163.2(4) ?
 N2 Fe1 N1 C12 78.5(4) ?
 N5 Fe1 N1 C12 -100.8(4) ?
 N4 Fe1 N1 C12 -15.2(4) ?
 N6 Fe1 N2 C1 21.5(5) ?
 N3 Fe1 N2 C1 116.7(5) ?
 N1 Fe1 N2 C1 -159.9(5) ?
 N5 Fe1 N2 C1 -155.5(9) ?
 N4 Fe1 N2 C1 -73.9(5) ?
 N6 Fe1 N2 C5 -158.4(4) ?
 N3 Fe1 N2 C5 -63.2(4) ?
 N1 Fe1 N2 C5 20.2(4) ?
 N5 Fe1 N2 C5 24.6(12) ?
 N4 Fe1 N2 C5 106.2(4) ?
 N6 Fe1 N3 C11 -22.8(5) ?
 N2 Fe1 N3 C11 -118.0(5) ?
 N1 Fe1 N3 C11 157.2(5) ?
 N5 Fe1 N3 C11 72.3(5) ?
 N4 Fe1 N3 C11 165.8(9) ?
 N6 Fe1 N3 C7 154.8(4) ?
 N2 Fe1 N3 C7 59.6(4) ?
 N1 Fe1 N3 C7 -25.2(4) ?
 N5 Fe1 N3 C7 -110.1(4) ?
 N4 Fe1 N3 C7 -16.5(12) ?
 N6 Fe1 N4 C13 -153.3(5) ?
 N3 Fe1 N4 C13 18.1(12) ?
 N2 Fe1 N4 C13 -57.2(5) ?
 N1 Fe1 N4 C13 26.7(5) ?
 N5 Fe1 N4 C13 112.6(5) ?
 N6 Fe1 N4 C18 -33.6(5) ?
 N3 Fe1 N4 C18 137.8(10) ?
 N2 Fe1 N4 C18 62.5(5) ?
 N1 Fe1 N4 C18 146.3(5) ?

N5 Fe1 N4 C18 -127.7(5) ?
N6 Fe1 N4 C14 87.6(5) ?
N3 Fe1 N4 C14 -101.1(11) ?
N2 Fe1 N4 C14 -176.3(5) ?
N1 Fe1 N4 C14 -92.5(5) ?
N5 Fe1 N4 C14 -6.6(5) ?
N6 Fe1 N5 C15 -71.2(5) ?
N3 Fe1 N5 C15 -167.4(5) ?
N2 Fe1 N5 C15 105.8(11) ?
N1 Fe1 N5 C15 110.1(5) ?
N4 Fe1 N5 C15 23.5(5) ?
N6 Fe1 N5 C19 47.7(5) ?
N3 Fe1 N5 C19 -48.5(5) ?
N2 Fe1 N5 C19 -135.3(10) ?
N1 Fe1 N5 C19 -130.9(5) ?
N4 Fe1 N5 C19 142.4(5) ?
N6 Fe1 N5 C16 172.3(5) ?
N3 Fe1 N5 C16 76.1(5) ?
N2 Fe1 N5 C16 -10.7(13) ?
N1 Fe1 N5 C16 -6.3(5) ?
N4 Fe1 N5 C16 -93.0(5) ?
C5 N2 C1 C2 -1.0(8) ?
Fe1 N2 C1 C2 179.1(4) ?
N2 C1 C2 C3 -1.3(9) ?
C1 C2 C3 C4 2.1(9) ?
C2 C3 C4 C5 -0.6(9) ?
C1 N2 C5 C4 2.5(8) ?
Fe1 N2 C5 C4 -177.5(5) ?
C1 N2 C5 C6 -171.9(5) ?
Fe1 N2 C5 C6 8.0(5) ?
C3 C4 C5 N2 -1.7(9) ?
C3 C4 C5 C6 171.9(5) ?
C17 N1 C6 C7 60.2(5) ?
C12 N1 C6 C7 -171.8(4) ?
Fe1 N1 C6 C7 -54.9(4) ?
C17 N1 C6 C5 170.1(4) ?
C12 N1 C6 C5 -61.9(5) ?
Fe1 N1 C6 C5 55.0(4) ?
N2 C5 C6 N1 -43.7(6) ?
C4 C5 C6 N1 142.0(6) ?
N2 C5 C6 C7 68.1(5) ?
C4 C5 C6 C7 -106.2(6) ?
C11 N3 C7 C8 1.1(8) ?
Fe1 N3 C7 C8 -176.9(4) ?
C11 N3 C7 C6 175.8(5) ?
Fe1 N3 C7 C6 -2.2(5) ?
N1 C6 C7 N3 39.6(6) ?
C5 C6 C7 N3 -72.5(5) ?
N1 C6 C7 C8 -145.8(5) ?
C5 C6 C7 C8 102.2(6) ?
N3 C7 C8 C9 -1.3(9) ?
C6 C7 C8 C9 -175.3(5) ?
C7 C8 C9 C10 0.6(9) ?
C8 C9 C10 C11 0.1(9) ?
C7 N3 C11 C10 -0.4(8) ?
Fe1 N3 C11 C10 177.1(4) ?
C9 C10 C11 N3 -0.2(9) ?
C17 N1 C12 C13 -122.1(7) ?
C6 N1 C12 C13 109.7(7) ?
Fe1 N1 C12 C13 -0.2(7) ?
C18 N4 C13 C12 -159.2(7) ?
C14 N4 C13 C12 82.0(8) ?
Fe1 N4 C13 C12 -34.9(9) ?
N1 C12 C13 N4 24.8(10) ?
C13 N4 C14 C15 -127.1(7) ?
C18 N4 C14 C15 113.2(8) ?

Fe1 N4 C14 C15 -13.0(8) ?
 N4 C14 C15 N5 35.2(10) ?
 C19 N5 C15 C14 -162.3(7) ?
 C16 N5 C15 C14 78.6(8) ?
 Fe1 N5 C15 C14 -38.0(8) ?
 C15 N5 C16 C17 -126.4(7) ?
 C19 N5 C16 C17 116.0(7) ?
 Fe1 N5 C16 C17 -11.9(9) ?
 N5 C16 C17 N1 30.8(10) ?
 C6 N1 C17 C16 -143.2(6) ?
 C12 N1 C17 C16 87.6(7) ?
 Fe1 N1 C17 C16 -34.8(7) ?
 O4B O4A C11 O3B -173.7(11) ?
 O3B O4A C11 O2 -120.1(10) ?
 O4B O4A C11 O2 66.2(7) ?
 O3B O4A C11 O1 100.0(10) ?
 O4B O4A C11 O1 -73.7(7) ?
 O3B O4A C11 O4B 173.7(11) ?
 O3B O4A C11 O3A -12.1(9) ?
 O4B O4A C11 O3A 174.2(6) ?
 O3B O3A C11 O2 131.6(8) ?
 O3B O3A C11 O4A 10.6(8) ?
 O3B O3A C11 O1 -112.2(8) ?
 O3B O3A C11 O4B 22.2(15) ?
 O8B O8A C12 O6 38.8(11) ?
 O8B O8A C12 O5 -92.6(10) ?
 O8B O8A C12 O7 157.3(10) ?
 O4B O4A O3B O3A 24(2) ?
 C11 O4A O3B O3A 16.5(11) ?
 O4B O4A O3B C11 7.7(13) ?
 C11 O3A O3B O4A -16.8(12) ?
 O2 C11 O3B O4A 92.4(10) ?
 O1 C11 O3B O4A -105.1(7) ?
 O4B C11 O3B O4A -5.1(9) ?
 O3A C11 O3B O4A 165.9(10) ?
 O2 C11 O3B O3A -73.5(9) ?
 O4A C11 O3B O3A -165.9(10) ?
 O1 C11 O3B O3A 89.0(6) ?
 O4B C11 O3B O3A -171.1(6) ?
 O3B O4A O4B C11 -7.7(14) ?
 O3B C11 O4B O4A 4.7(8) ?
 O2 C11 O4B O4A -125.6(5) ?
 O1 C11 O4B O4A 121.4(4) ?
 O3A C11 O4B O4A -14.2(15) ?
 O6 C12 O8B O8A -149.6(8) ?
 O5 C12 O8B O8A 101.7(8) ?
 O7 C12 O8B O8A -36.6(16) ?

_diffrn_measured_fraction_theta_max	1.000
_diffrn_reflns_theta_full	25.00
_diffrn_measured_fraction_theta_full	1.000
_refine_diff_density_max	0.816
_refine_diff_density_min	-0.691
_refine_diff_density_rms	0.095

#==END