Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

Bis(diphenylmethylphosphine-κP)(disulfurdinitrido-$\kappa^2 N,S$)platinum(II) dichloromethane solvate

Benjamin D. Read, Alexandra M. Z. Slawin and J. Derek Woollins*

Department of Chemistry, University of St Andrews, St Andrews KY16 9ST, Scotland

Correspondence e-mail: jdw3@st-and.ac.uk

Key indicators

Single-crystal X-ray study
T = 93 K
Mean σ(C–C) = 0.013 Å
R factor = 0.051
wR factor = 0.115
Data-to-parameter ratio = 14.7

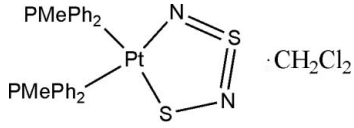
For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

Received 31 January 2007
Accepted 6 February 2007

The title compound, $[Pt(N_2S_2)(C_{13}H_{13}P)_2]\cdot CH_2Cl_2$, contains Pt^{II} in a square-planar coordination. The five-membered PtS_2N_2 ring contains two short and one long S—N bonds. Interestingly, the S—N bond lengths have a different pattern from those in the PMe_2Ph analogue and one of the published PPh_3 analogues, but are comparable with those in most other systems containing the disulfurdinitride anion.

Comment

The disulfurdintride dianion is not known in simple salts but can be isolated in metal complexes (Kelly & Woollins, 1986; Jones *et al.*, 1985*a*,*b*; Bates *et al.*, 1986). These complexes may be protonated at the metal-coordinated nitrogen (Jones *et al.*, 1986, 1988), and we have previously commented on the structural consequences of this protonation (Jones *et al.*, 1987). Recently, we developed a new route to diulfurdinitrido complexes (Aucott *et al.*, 2002) and have examined the metallation of the IrS_2N_2 and CoS_2N_2 rings using the $AuPR_3$ cation as a species which is isolobal with a proton (Aucott *et al.*, 2003; Slawin & Woollins, 2006).



(I)

The structure of the title compound, (I), a dichloromethane solvate, is shown in Fig. 1. In (I), the coordination of Pt^{II} is slightly distorted square-planar (Table 1), the five-membered PtS_2N_2 ring being essentially coplanar [maximum deviation from the $PtS_2N_2P_2$ mean plane is 0.06 (1) Å for P1]. The PtS_2N_2 ring contains two short [N1—S1 = 1.525 (7) and N2—S1 = 1.568 (8) Å] and one long S—N bonds [S2—N2 = 1.665 (7) Å]. Comparison of the S—N bond lengths for the various phosphine-substituted analogues containing this ring reveals that the S—N bond lengths have a different pattern from those in the PMe_2Ph analogue (Jones *et al.*, 1988) and one of the published PPh_3 analogues (Chivers *et al.*, 1986), but are comparable with those in most others systems containing the disulfurdinitride anion (Jones *et al.*, 1985*a*; Bates *et al.*, 1986).

Experimental

Compound (I) was prepared as described previously (Belton *et al.*, 1988). $[S_4N_3]Cl$ (0.050 g, 0.24 mmol) was added to liquid NH_3 (15 ml) at 195 K. After stirring for 30 min, solid $Pt(PPh_2Me)_2Cl_2$ (0.120 g,

0.18 mmol) was added and the reaction allowed to warm to room temperature over a period of 4 h, during which time the ammonia evaporated. Residual ammonia was removed *in vacuo* and the resulting solid was extracted into dichloromethane, filtered through Celite and subjected to column chromatography using silica gel [CH_2Cl_2/hexane (1:1) eluent] to give the final product (0.075 g, 0.11 mmol) in 55% yield. Recrystallization from a dichloromethane/hexane (1:1) mixture gave yellow plates.

Crystal data

$[Pt(N_2S_2)(C_{13}H_{13}P)_2]\cdot CH_2Cl_2$
M_r = 772.56
Monoclinic, $P2_1/n$
a = 12.792 (2) Å
b = 12.289 (2) Å
c = 18.564 (4) Å
β = 107.160 (9)°
V = 2788.4 (9) Å^3
Z = 4
D_x = 1.840 Mg m^{-3}
Mo $K\alpha$ radiation
μ = 5.51 mm^{-1}
T = 93 (2) K
Plate, yellow
0.10 × 0.10 × 0.03 mm

Data collection

Rigaku Mercury CCD diffractometer
ω and φ scans
Absorption correction: multi-scan *CrystalClear* (Rigaku, 2004)
T_{min} = 0.587, T_{max} = 0.856
16094 measured reflections
4810 independent reflections
3935 reflections with $I > 2\sigma(I)$
R_{int} = 0.070
θ_{max} = 25.4°

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)]$ = 0.051
$wR(F^2)$ = 0.115
S = 1.05
4810 reflections
328 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0544P)^2 + 24.9689P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max}$ = 0.003
$\Delta\rho_{max}$ = 1.28 e Å^{-3}
$\Delta\rho_{min}$ = −2.11 e Å^{-3}

Table 1
Selected geometric parameters (Å, °).

Pt1—N1	2.052 (7)	Pt1—S2	2.271 (2)
Pt1—P2	2.243 (2)	Pt1—P1	2.281 (2)
N1—Pt1—S2	87.7 (2)	N1—Pt1—P1	83.6 (2)
P2—Pt1—S2	89.67 (8)	P2—Pt1—P1	99.00 (8)

All H atoms were included in calculated positions (C—H = 0.98 Å for methyl H atoms, 0.99 Å for methylene H atoms and 0.95 Å for aryl H atoms) and were refined as riding atoms, with U_{iso}(H) = 1.2U_{eq}(methylene and aryl C) or 1.5U_{eq}(methyl C). The highest peak in the difference map is 1.48 Å from atom Pt1 and the deepest hole is 0.89 Å from the same atom.

Data collection: *CrystalClear* (Rigaku, 2004); cell refinement: *CrystalClear*; data reduction: *CrystalClear*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *SHELXTL* (Sheldrick, 2003); software used to prepare material for publication: *SHELXTL*.

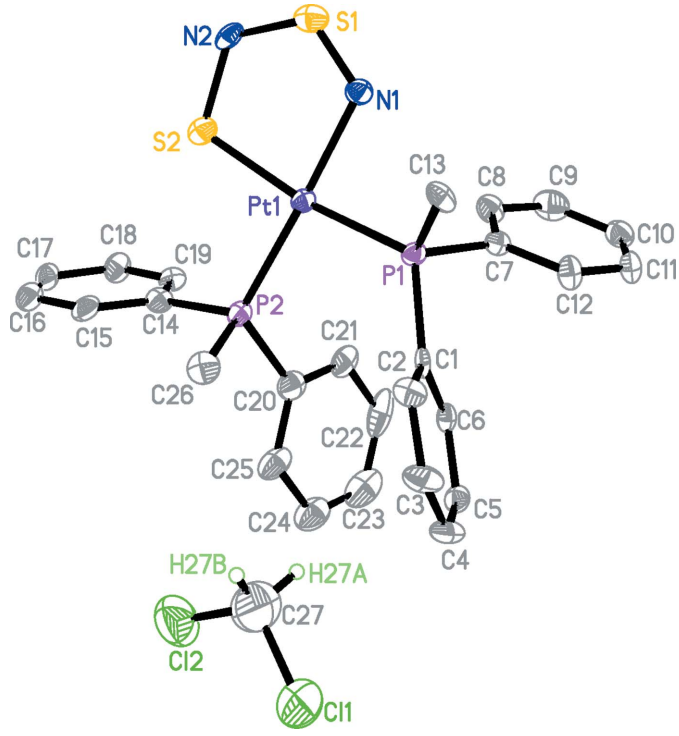


Figure 1
The molecular structure of (I), with displacement ellipsoids drawn at the 50% probability level. H atoms of the complex molecule have been omitted.

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supporting information

Acta Cryst. (2007). E**63**, m751–m752 [https://doi.org/10.1107/S1600536807006344]

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$b = 12.289$ (2) Å
$c = 18.564$ (4) Å
$\beta = 107.160$ (9)°
$V = 2788.4$ (9) Å^3
$Z = 4$
$F(000) = 1512$
$D_x = 1.840$ Mg m^{-3}
Mo $K\alpha$ radiation, $\lambda = 0.71073$ Å
Cell parameters from 8893 reflections
$\theta = 1.7$–27.4°
$\mu = 5.51$ mm^{-1}
$T = 93$ K
Plate, yellow
0.10 × 0.10 × 0.03 mm

Data collection

Rigaku Mercury CCD diffractometer
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Detector resolution: 0.83 pixels mm^{-1}
ω and φ scans
Absorption correction: multi-scan CrystalClear (Rigaku, 2004)
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4810 independent reflections
3935 reflections with $I > 2\sigma(I)$
$R_{int} = 0.070$
$\theta_{max} = 25.4°$, $\theta_{min} = 2.0°$
$h = -14\rightarrow12$
$k = -12\rightarrow14$
$l = -17\rightarrow22$

Refinement

Refinement on F^2
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)] = 0.051$
$wR(F^2) = 0.115$
$S = 1.05$
4810 reflections
328 parameters
0 restraints
Primary atom site location: structure-invariant direct methods
Secondary atom site location: difference Fourier map
Hydrogen site location: inferred from neighbouring sites
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0544P)^2 + 24.9689P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} = 0.003$
$\Delta\rho_{max} = 1.28$ e Å^{-3}
$\Delta\rho_{min} = -2.11$ e Å^{-3}

Special details

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

Refinement. 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 $F^2 > \sigma(F^2)$ 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.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å²)

	x	*y*	*z*	U_{iso}*/U_{eq}
Pt1	0.56215 (2)	0.08329 (2)	0.763103 (18)	0.01649 (12)
N1	0.6647 (6)	0.0010 (6)	0.8524 (4)	0.0215 (16)
S1	0.68253 (19)	−0.11842 (19)	0.83715 (14)	0.0289 (5)
N2	0.6204 (6)	−0.1630 (5)	0.7568 (4)	0.0214 (16)
S2	0.54256 (18)	−0.07438 (17)	0.69660 (13)	0.0244 (5)
P1	0.60903 (17)	0.22984 (16)	0.84141 (12)	0.0166 (5)
C1	0.5754 (6)	0.3682 (7)	0.8097 (4)	0.0161 (17)
C2	0.6506 (7)	0.4331 (7)	0.7873 (5)	0.023 (2)
H2A	0.7178	0.4028	0.7850	0.028*
C3	0.6270 (8)	0.5408 (7)	0.7686 (5)	0.029 (2)
H3A	0.6787	0.5848	0.7544	0.035*
C4	0.5286 (8)	0.5848 (7)	0.7706 (5)	0.029 (2)
H4A	0.5127	0.6590	0.7576	0.035*
C5	0.4538 (7)	0.5219 (7)	0.7912 (5)	0.0200 (19)
H5A	0.3855	0.5520	0.7914	0.024*
C6	0.4773 (6)	0.4157 (7)	0.8115 (4)	0.0164 (17)
H6A	0.4258	0.3734	0.8272	0.020*
C7	0.5597 (6)	0.2266 (6)	0.9228 (5)	0.0176 (18)
C8	0.4935 (7)	0.1416 (7)	0.9343 (5)	0.025 (2)
H8A	0.4759	0.0825	0.8999	0.030*
C9	0.4533 (8)	0.1440 (8)	0.9966 (6)	0.034 (2)
H9A	0.4080	0.0868	1.0045	0.041*
C10	0.4799 (7)	0.2303 (7)	1.0469 (5)	0.026 (2)
H10A	0.4524	0.2321	1.0892	0.031*
C11	0.5451 (7)	0.3122 (8)	1.0360 (5)	0.025 (2)
H11A	0.5635	0.3707	1.0709	0.030*
C12	0.5847 (7)	0.3108 (7)	0.9745 (5)	0.0229 (19)
H12A	0.6299	0.3688	0.9675	0.027*
C13	0.7547 (6)	0.2322 (7)	0.8806 (5)	0.0207 (19)
H13A	0.7755	0.2900	0.9186	0.031*
H13B	0.7885	0.2461	0.8405	0.031*
H13C	0.7799	0.1618	0.9043	0.031*
P2	0.44798 (17)	0.16590 (17)	0.66274 (12)	0.0178 (5)
C14	0.3725 (6)	0.0744 (7)	0.5899 (5)	0.0207 (18)
C15	0.3913 (7)	0.0640 (7)	0.5210 (5)	0.025 (2)

H15A	0.4463	0.1073	0.5102	0.030*
C16	0.3322 (7)	−0.0080 (7)	0.4672 (5)	0.025 (2)
H16A	0.3462	−0.0132	0.4199	0.030*
C17	0.2532 (7)	−0.0718 (7)	0.4822 (5)	0.024 (2)
H17A	0.2119	−0.1211	0.4452	0.028*
C18	0.2341 (7)	−0.0642 (7)	0.5515 (5)	0.026 (2)
H18A	0.1807	−0.1096	0.5626	0.032*
C19	0.2916 (6)	0.0085 (7)	0.6042 (5)	0.0201 (18)
H19A	0.2765	0.0143	0.6512	0.024*
C20	0.3393 (7)	0.2459 (8)	0.6810 (5)	0.027 (2)
C21	0.3000 (7)	0.2178 (7)	0.7389 (5)	0.027 (2)
H21A	0.3301	0.1574	0.7701	0.033*
C22	0.2154 (8)	0.2781 (9)	0.7524 (6)	0.042 (3)
H22A	0.1867	0.2590	0.7924	0.050*
C23	0.1737 (8)	0.3669 (9)	0.7062 (7)	0.045 (3)
H23A	0.1168	0.4090	0.7155	0.054*
C24	0.2121 (8)	0.3941 (9)	0.6488 (7)	0.040 (3)
H24A	0.1828	0.4549	0.6178	0.049*
C25	0.2939 (7)	0.3335 (8)	0.6355 (6)	0.035 (2)
H25A	0.3202	0.3516	0.5943	0.041*
C26	0.5160 (7)	0.2584 (8)	0.6160 (5)	0.028 (2)
H26A	0.4623	0.2905	0.5722	0.042*
H26B	0.5713	0.2188	0.5994	0.042*
H26C	0.5516	0.3163	0.6511	0.042*
C27	0.4448 (13)	0.5725 (11)	0.5806 (9)	0.077 (5)
H27A	0.4308	0.5403	0.6258	0.093*
H27B	0.5180	0.5481	0.5794	0.093*
Cl1	0.4442 (3)	0.7125 (3)	0.5876 (2)	0.0641 (9)
Cl2	0.3467 (3)	0.5255 (3)	0.50033 (19)	0.0733 (11)

Atomic displacement parameters (Å²)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
Pt1	0.01529 (17)	0.01477 (19)	0.01922 (18)	−0.00008 (13)	0.00479 (12)	−0.00056 (13)
N1	0.026 (4)	0.018 (4)	0.022 (4)	0.002 (3)	0.009 (3)	0.004 (3)
S1	0.0283 (12)	0.0254 (12)	0.0347 (14)	0.0044 (9)	0.0118 (10)	0.0079 (10)
N2	0.029 (4)	0.010 (4)	0.031 (4)	−0.001 (3)	0.016 (3)	−0.002 (3)
S2	0.0267 (11)	0.0185 (12)	0.0293 (12)	0.0005 (9)	0.0103 (9)	−0.0003 (9)
P1	0.0176 (11)	0.0116 (11)	0.0195 (11)	−0.0012 (8)	0.0041 (8)	−0.0003 (8)
C1	0.019 (4)	0.021 (4)	0.008 (4)	−0.008 (3)	0.004 (3)	−0.006 (3)
C2	0.017 (4)	0.027 (5)	0.027 (5)	0.002 (4)	0.008 (4)	0.006 (4)
C3	0.028 (5)	0.020 (5)	0.037 (6)	−0.007 (4)	0.006 (4)	0.013 (4)
C4	0.033 (5)	0.023 (5)	0.030 (5)	0.011 (4)	0.006 (4)	0.009 (4)
C5	0.017 (4)	0.022 (5)	0.020 (5)	0.003 (3)	0.005 (3)	−0.002 (3)
C6	0.019 (4)	0.019 (4)	0.014 (4)	−0.005 (3)	0.008 (3)	−0.003 (3)
C7	0.015 (4)	0.016 (4)	0.020 (4)	−0.003 (3)	0.002 (3)	0.001 (3)
C8	0.026 (5)	0.025 (5)	0.023 (5)	−0.002 (4)	0.006 (4)	0.003 (4)
C9	0.036 (6)	0.031 (6)	0.038 (6)	−0.001 (4)	0.016 (5)	0.012 (5)

C10	0.027 (5)	0.029 (5)	0.023 (5)	0.005 (4)	0.010 (4)	0.005 (4)
C11	0.030 (5)	0.029 (5)	0.016 (5)	−0.002 (4)	0.005 (4)	−0.005 (4)
C12	0.023 (5)	0.026 (5)	0.020 (5)	−0.010 (4)	0.008 (4)	−0.003 (4)
C13	0.015 (4)	0.025 (5)	0.018 (4)	−0.006 (3)	−0.003 (3)	0.003 (3)
P2	0.0137 (10)	0.0182 (11)	0.0202 (12)	0.0004 (8)	0.0032 (8)	−0.0030 (9)
C14	0.013 (4)	0.023 (5)	0.024 (5)	0.002 (3)	0.002 (3)	0.000 (4)
C15	0.023 (5)	0.023 (5)	0.030 (5)	0.009 (4)	0.009 (4)	−0.002 (4)
C16	0.023 (5)	0.026 (5)	0.027 (5)	0.003 (4)	0.007 (4)	−0.004 (4)
C17	0.023 (4)	0.024 (5)	0.021 (5)	0.001 (4)	0.000 (4)	−0.007 (4)
C18	0.024 (5)	0.025 (5)	0.029 (5)	−0.004 (4)	0.006 (4)	−0.007 (4)
C19	0.015 (4)	0.019 (5)	0.026 (5)	0.000 (3)	0.006 (3)	0.001 (4)
C20	0.024 (5)	0.025 (5)	0.029 (5)	0.000 (4)	0.001 (4)	−0.005 (4)
C21	0.021 (5)	0.025 (5)	0.033 (5)	−0.005 (4)	0.004 (4)	−0.012 (4)
C22	0.029 (5)	0.054 (7)	0.048 (7)	−0.022 (5)	0.021 (5)	−0.034 (6)
C23	0.020 (5)	0.044 (7)	0.064 (8)	0.003 (5)	0.002 (5)	−0.020 (6)
C24	0.027 (5)	0.038 (6)	0.049 (7)	0.010 (4)	0.000 (5)	−0.009 (5)
C25	0.020 (5)	0.033 (6)	0.044 (6)	0.008 (4)	−0.002 (4)	−0.013 (5)
C26	0.022 (5)	0.030 (5)	0.033 (5)	0.000 (4)	0.011 (4)	0.001 (4)
C27	0.075 (10)	0.067 (10)	0.069 (10)	0.007 (8)	−0.011 (8)	−0.013 (7)
Cl1	0.078 (2)	0.0510 (19)	0.062 (2)	−0.0059 (16)	0.0180 (17)	−0.0076 (15)
Cl2	0.092 (3)	0.070 (2)	0.047 (2)	−0.0116 (19)	0.0031 (17)	−0.0013 (16)

Geometric parameters (Å, º)

Pt1—N1	2.052 (7)	C13—H13C	0.9800
Pt1—P2	2.243 (2)	P2—C26	1.802 (9)
Pt1—S2	2.271 (2)	P2—C14	1.804 (8)
Pt1—P1	2.281 (2)	P2—C20	1.815 (9)
N1—S1	1.525 (7)	C14—C15	1.374 (13)
S1—N2	1.568 (8)	C14—C19	1.400 (12)
N2—S2	1.665 (7)	C15—C16	1.380 (12)
P1—C13	1.789 (8)	C15—H15A	0.9500
P1—C7	1.801 (9)	C16—C17	1.371 (13)
P1—C1	1.809 (8)	C16—H16A	0.9500
C1—C6	1.393 (11)	C17—C18	1.381 (13)
C1—C2	1.404 (12)	C17—H17A	0.9500
C2—C3	1.378 (13)	C18—C19	1.368 (12)
C2—H2A	0.9500	C18—H18A	0.9500
C3—C4	1.381 (14)	C19—H19A	0.9500
C3—H3A	0.9500	C20—C21	1.358 (13)
C4—C5	1.370 (13)	C20—C25	1.385 (14)
C4—H4A	0.9500	C21—C22	1.394 (14)
C5—C6	1.367 (12)	C21—H21A	0.9500
C5—H5A	0.9500	C22—C23	1.392 (16)
C6—H6A	0.9500	C22—H22A	0.9500
C7—C12	1.384 (12)	C23—C24	1.340 (17)
C7—C8	1.400 (12)	C23—H23A	0.9500
C8—C9	1.397 (14)	C24—C25	1.365 (14)

C8—H8A	0.9500	C24—H24A	0.9500
C9—C10	1.387 (14)	C25—H25A	0.9500
C9—H9A	0.9500	C26—H26A	0.9800
C10—C11	1.361 (13)	C26—H26B	0.9800
C10—H10A	0.9500	C26—H26C	0.9800
C11—C12	1.378 (12)	C27—Cl1	1.726 (14)
C11—H11A	0.9500	C27—Cl2	1.740 (14)
C12—H12A	0.9500	C27—H27A	0.9900
C13—H13A	0.9800	C27—H27B	0.9900
C13—H13B	0.9800		

N1—Pt1—P2	177.4 (2)	H13A—C13—H13C	109.5
N1—Pt1—S2	87.7 (2)	H13B—C13—H13C	109.5
P2—Pt1—S2	89.67 (8)	C26—P2—C14	105.1 (4)
N1—Pt1—P1	83.6 (2)	C26—P2—C20	104.7 (4)
P2—Pt1—P1	99.00 (8)	C14—P2—C20	102.0 (4)
S2—Pt1—P1	170.46 (8)	C26—P2—Pt1	113.4 (3)
S1—N1—Pt1	114.8 (4)	C14—P2—Pt1	114.4 (3)
N1—S1—N2	116.9 (4)	C20—P2—Pt1	115.9 (3)
S1—N2—S2	116.4 (4)	C15—C14—C19	117.7 (8)
N2—S2—Pt1	104.2 (3)	C15—C14—P2	123.6 (7)
C13—P1—C7	103.9 (4)	C19—C14—P2	118.7 (7)
C13—P1—C1	103.7 (4)	C14—C15—C16	121.6 (9)
C7—P1—C1	100.7 (4)	C14—C15—H15A	119.2
C13—P1—Pt1	108.6 (3)	C16—C15—H15A	119.2
C7—P1—Pt1	115.2 (3)	C17—C16—C15	120.0 (9)
C1—P1—Pt1	122.8 (3)	C17—C16—H16A	120.0
C6—C1—C2	118.0 (8)	C15—C16—H16A	120.0
C6—C1—P1	121.0 (6)	C16—C17—C18	119.6 (8)
C2—C1—P1	120.8 (6)	C16—C17—H17A	120.2
C3—C2—C1	120.1 (8)	C18—C17—H17A	120.2
C3—C2—H2A	119.9	C19—C18—C17	120.3 (9)
C1—C2—H2A	119.9	C19—C18—H18A	119.8
C2—C3—C4	120.2 (9)	C17—C18—H18A	119.8
C2—C3—H3A	119.9	C18—C19—C14	120.8 (8)
C4—C3—H3A	119.9	C18—C19—H19A	119.6
C5—C4—C3	120.3 (8)	C14—C19—H19A	119.6
C5—C4—H4A	119.9	C21—C20—C25	119.6 (9)
C3—C4—H4A	119.9	C21—C20—P2	119.5 (7)
C6—C5—C4	120.0 (8)	C25—C20—P2	120.9 (8)
C6—C5—H5A	120.0	C20—C21—C22	119.6 (10)
C4—C5—H5A	120.0	C20—C21—H21A	120.2
C5—C6—C1	121.3 (8)	C22—C21—H21A	120.2
C5—C6—H6A	119.3	C23—C22—C21	118.9 (10)
C1—C6—H6A	119.3	C23—C22—H22A	120.6
C12—C7—C8	118.6 (8)	C21—C22—H22A	120.6
C12—C7—P1	119.9 (6)	C24—C23—C22	121.4 (10)
C8—C7—P1	121.5 (6)	C24—C23—H23A	119.3

C9—C8—C7	119.9 (9)	C22—C23—H23A	119.3
C9—C8—H8A	120.1	C23—C24—C25	119.1 (11)
C7—C8—H8A	120.1	C23—C24—H24A	120.4
C10—C9—C8	119.7 (9)	C25—C24—H24A	120.4
C10—C9—H9A	120.1	C24—C25—C20	121.3 (11)
C8—C9—H9A	120.1	C24—C25—H25A	119.3
C11—C10—C9	120.3 (9)	C20—C25—H25A	119.3
C11—C10—H10A	119.9	P2—C26—H26A	109.5
C9—C10—H10A	119.9	P2—C26—H26B	109.5
C10—C11—C12	120.4 (8)	H26A—C26—H26B	109.5
C10—C11—H11A	119.8	P2—C26—H26C	109.5
C12—C11—H11A	119.8	H26A—C26—H26C	109.5
C11—C12—C7	121.2 (8)	H26B—C26—H26C	109.5
C11—C12—H12A	119.4	Cl1—C27—Cl2	112.2 (8)
C7—C12—H12A	119.4	Cl1—C27—H27A	109.2
P1—C13—H13A	109.5	Cl2—C27—H27A	109.2
P1—C13—H13B	109.5	Cl1—C27—H27B	109.2
H13A—C13—H13B	109.5	Cl2—C27—H27B	109.2
P1—C13—H13C	109.5	H27A—C27—H27B	107.9

S2—Pt1—N1—S1	0.4 (4)	C10—C11—C12—C7	−0.3 (14)
P1—Pt1—N1—S1	−175.6 (4)	C8—C7—C12—C11	−0.4 (13)
Pt1—N1—S1—N2	−0.6 (6)	P1—C7—C12—C11	177.9 (7)
N1—S1—N2—S2	0.6 (6)	S2—Pt1—P2—C26	−107.1 (3)
S1—N2—S2—Pt1	−0.2 (5)	P1—Pt1—P2—C26	68.9 (3)
N1—Pt1—S2—N2	−0.1 (3)	S2—Pt1—P2—C14	13.4 (3)
P2—Pt1—S2—N2	−179.6 (3)	P1—Pt1—P2—C14	−170.6 (3)
N1—Pt1—P1—C13	48.4 (4)	S2—Pt1—P2—C20	131.7 (3)
P2—Pt1—P1—C13	−131.9 (3)	P1—Pt1—P2—C20	−52.3 (3)
N1—Pt1—P1—C7	−67.6 (4)	C26—P2—C14—C15	15.6 (8)
P2—Pt1—P1—C7	112.1 (3)	C20—P2—C14—C15	124.6 (8)
N1—Pt1—P1—C1	169.3 (4)	Pt1—P2—C14—C15	−109.4 (7)
P2—Pt1—P1—C1	−11.0 (3)	C26—P2—C14—C19	−165.6 (7)
C13—P1—C1—C6	−147.0 (6)	C20—P2—C14—C19	−56.6 (7)
C7—P1—C1—C6	−39.8 (7)	Pt1—P2—C14—C19	69.3 (7)
Pt1—P1—C1—C6	89.8 (6)	C19—C14—C15—C16	0.6 (12)
C13—P1—C1—C2	28.7 (8)	P2—C14—C15—C16	179.4 (7)
C7—P1—C1—C2	136.0 (7)	C14—C15—C16—C17	−0.6 (13)
Pt1—P1—C1—C2	−94.5 (7)	C15—C16—C17—C18	−0.5 (13)
C6—C1—C2—C3	0.6 (12)	C16—C17—C18—C19	1.6 (13)
P1—C1—C2—C3	−175.2 (7)	C17—C18—C19—C14	−1.6 (13)
C1—C2—C3—C4	−1.1 (14)	C15—C14—C19—C18	0.5 (12)
C2—C3—C4—C5	0.1 (14)	P2—C14—C19—C18	−178.4 (7)
C3—C4—C5—C6	1.4 (13)	C26—P2—C20—C21	−154.5 (7)
C4—C5—C6—C1	−1.9 (12)	C14—P2—C20—C21	96.2 (7)
C2—C1—C6—C5	0.9 (12)	Pt1—P2—C20—C21	−28.8 (8)
P1—C1—C6—C5	176.7 (6)	C26—P2—C20—C25	27.2 (8)
C13—P1—C7—C12	60.6 (8)	C14—P2—C20—C25	−82.1 (8)

C1—P1—C7—C12	−46.5 (7)	Pt1—P2—C20—C25	152.9 (6)
Pt1—P1—C7—C12	179.2 (6)	C25—C20—C21—C22	−0.7 (13)
C13—P1—C7—C8	−121.2 (7)	P2—C20—C21—C22	−179.0 (6)
C1—P1—C7—C8	131.7 (7)	C20—C21—C22—C23	−0.6 (13)
Pt1—P1—C7—C8	−2.6 (8)	C21—C22—C23—C24	1.0 (15)
C12—C7—C8—C9	0.7 (12)	C22—C23—C24—C25	0.0 (16)
P1—C7—C8—C9	−177.6 (7)	C23—C24—C25—C20	−1.3 (15)
C7—C8—C9—C10	−0.4 (14)	C21—C20—C25—C24	1.7 (14)
C8—C9—C10—C11	−0.2 (14)	P2—C20—C25—C24	−180.0 (8)
C9—C10—C11—C12	0.6 (14)		