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Bis(2,9-dimethyl-1,10-phenanthrolinium) hexachloridoplatinate(IV)

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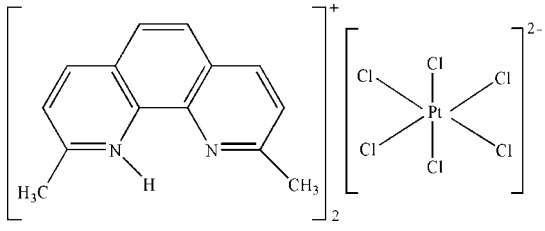
Key indicators: single-crystal X-ray study; T = 120 K; mean σ(C–C) = 0.007 Å; R factor = 0.037; wR factor = 0.100; data-to-parameter ratio = 20.9.

The asymmetric unit of the title compound, $(C_{14}H_{13}N_2)_2[PtCl_6]$, contains one independent protonated 2,9-dimethyl-1,10-phenanthrolinium cation and half of a centrosymmetric $[PtCl_6]^{2-}$ anion. The Pt ion has an octahedral coordination. Intramolecular N—H···Cl and N—H···N hydrogen bonds help to stabilize the structure.

Related literature

For related literature, see: Yousefi, Amani *et al.* (2007); Yousefi, Teimouri *et al.* (2007*a*,*b*,*c*); Morsali (2005); Yu *et al.* (2006); Moreno *et al.* (2006); Veidis *et al.* (1981); Zordan & Brammer (2004); Hasan *et al.* (2001); Juan *et al.* (1998); Li & Liu (2003); Hu *et al.* (2003); Terzis & Mentzafos (1983); Bencini *et al.* (1992); Ciccarese *et al.* (1998); Delafontaine *et al.* (1987); Bokach *et al.* (2003); Zordan *et al.* (2005).



Experimental

Crystal data

$(C_{14}H_{13}N_2)_2[PtCl_6]$
M_r = 826.31
Triclinic, $P\overline{1}$
a = 8.9617 (10) Å
b = 9.2179 (10) Å
c = 9.9930 (11) Å
α = 78.427 (9)°
β = 66.464 (8)°
γ = 79.540 (9)°
V = 736.70 (14) Å^3
Z = 1
Mo $K\alpha$ radiation
μ = 5.33 mm^{-1}
T = 120 (2) K
0.50 × 0.27 × 0.25 mm

Data collection

Stoe IPDSII diffractometer
Absorption correction: numerical (shape of crystal determined optically)
T_{min} = 0.195, T_{max} = 0.265
8112 measured reflections
3817 independent reflections
3813 reflections with $I > 2\sigma(I)$
R_{int} = 0.073

Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.037
$wR(F^2)$ = 0.100
S = 1.10
3817 reflections
183 parameters
H atoms treated by a mixture of independent and constrained refinement
$\Delta\rho_{max}$ = 2.93 e Å^{-3}
$\Delta\rho_{min}$ = −3.20 e Å^{-3}

Table 1
Selected geometric parameters (Å, °).

Pt1—Cl1	2.3184 (10)	Pt1—Cl3	2.3263 (11)
Pt1—Cl2	2.3235 (9)		
Cl1—Pt1—Cl2	91.41 (4)	Cl2—Pt1—Cl3^{i}	91.76 (4)
Cl1—Pt1—Cl2^{i}	88.59 (4)	Cl1—Pt1—Cl3	89.41 (4)
Cl1—Pt1—Cl3^{i}	90.59 (4)	Cl2—Pt1—Cl3	88.24 (4)

Symmetry code: (i) $-x, -y+1, -z$.

Table 2
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
N2—H2···Cl3	0.93 (7)	2.73 (7)	3.418 (4)	132 (5)
N2—H2···N1	0.93 (7)	2.32 (7)	2.711 (6)	105 (5)

Data collection: *X-AREA* (Stoe & Cie, 2005); cell refinement: *X-AREA*; data reduction: *X-RED* (Stoe & Cie, 2005); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *ORTEP-3 for Windows* (Farrugia, 1997); software used to prepare material for publication: *WinGX* (Farrugia, 1999).

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Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: HK2386).

References

Bencini, A., Bianchi, A., Dapporto, P., Espana, E. G., Micheloni, M., Ramirez, J. A., Paoletti, P. & Paolil, P. (1992). *Inorg. Chem.* **31**, 1902–1908.
Bokach, N. A., Pakhomova, T. B., Kukushkin, V. Y., Haukka, M. & Pombeiro, A. J. L. (2003). *Inorg. Chem.* **42**, 7560–7568.
Ciccarese, A., Clemente, D. A., Fanizzi, F. P., Marzotto, A. & Valle, G. (1998). *Inorg. Chim. Acta*, **275–276**, 419–426.
Delafontaine, J.-M., Toffoli, P., Khodadad, P., Rodier, N. & Julien, R. (1987). *Acta Cryst.* C**43**, 1048–1050.
Farrugia, L. J. (1997). *J. Appl. Cryst.* **30**, 565.
Farrugia, L. J. (1999). *J. Appl. Cryst.* **32**, 837–838.
Hasan, M., Kozhevnikov, I. V., Siddiqui, M. R. H., Femoni, C., Steiner, A. & Winterton, N. (2001). *Inorg. Chem.* **40**, 795–800.
Hu, N. H., Norifusa, T. & Aoki, K. (2003). *Dalton Trans.* pp. 335–341.
Juan, C., Mareque, R. & Lee, B. (1998). *Inorg. Chem.* **37**, 4756–4757.
Li, D. & Liu, D. (2003). *Anal. Sci.* **19**, 1089–1090.

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Moreno, M. A., Haukka, M., Kallinen, M. & Pakkanen, T. A. (2006). *Appl. Organomet. Chem.* **20**, 51–69.
Morsali, A. (2005). *Anal. Sci.* **21**, x21–x22.
Sheldrick, G. M. (1997). *SHELXL97* and *SHELXS97*. University of Göttingen, Germany.
Stoe & Cie (2005). *X-AREA* and *X-RED*. Stoe & Cie, Darmstadt, Germany.
Terzis, A. & Mentzafos, D. (1983). *Inorg. Chem.* **22**, 1140–1143.
Veidis, M. V., Witten, E. H., Reiff, W. M., Brennan, T. F. & Garafalo, A. R. (1981). *Inorg. Chim. Acta*, **54**, L133–L135.
Yousefi, M., Amani, V. & Khavasi, H. R. (2007). *Acta Cryst.* E**63**, o3782.
Yousefi, M., Teimouri, S., Amani, V. & Khavasi, H. R. (2007*a*). *Acta Cryst.* E**63**, m2460–m2461.
Yousefi, M., Teimouri, S., Amani, V. & Khavasi, H. R. (2007*b*). *Acta Cryst.* E**63**, m2748–m2749.
Yousefi, M., Teimouri, S., Amani, V. & Khavasi, H. R. (2007*c*). *Acta Cryst.* E**63**, m2869–m2870.
Yu, Y.-Q., Ding, C.-F., Zhang, M.-L., Li, X.-M. & Zhang, S.-S. (2006). *Acta Cryst.* E**62**, o2187–o2189.
Zordan, F. & Brammer, L. (2004). *Acta Cryst.* B**60**, 512–519.
Zordan, F., Purver, S. L., Adams, H. & Brammer, L. (2005). *CrystEngComm*, **7**, 350–354.

supplementary materials

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Bis(2,9-dimethyl-1,10-phenanthrolinium) hexachloridoplatinate(IV)

M. Yousefi, R. Ahmadi, V. Amani and H. R. Khavasi

Comment

We reported the synthesis and crystal structure of [(H_2DA18C6)Cl_2], (II), (Yousefi *et al.*, 2007), [H_2DA18C6][$PtCl_6$]·2H_2O, (III), (Yousefi *et al.*, 2007*a*) and [TBA]$_3$[$PtCl_6$]Cl, (IV), (Yousefi *et al.*, 2007*b*) [where H_2DA18C6 is 1,10-Diazonia-18-crown-6 and TBA is tribenzylammonium], recently. We have also, reported the synthesis and crystal structure of [$PtCl_4$(pz)$_2$], (V), (Yousefi *et al.*, 2007*c*) [where pz is pyrazine]. Several proton transfer systems using 2,9-dimethyl-1,10-phenanthroline, with proton donor molecules, such as [Dmphen](ClO_4), (VI), (Morsali, 2005), [Dmphen](NO_3), (VII), (Yu *et al.*, 2006), [Dmphen][$Ru(CO)_3Cl_3$], (VIII), (Moreno *et al.*, 2006) and [Dmphen] [$FeCl_4$], (IX), (Veidis *et al.*, 1981) [where Dmphen is 2,9-dimethyl-1,10 -phenanthrolinium] have been synthesized and characterized by single-crystal X-ray diffraction methods.

There are also several proton transfer systems using H_2[$PtCl_6$] with proton acceptor molecules, such as [HpyBr-3]$_2$[$PtCl_6$]·2H_2O, (*X*), and [HpyI-3]$_2$ [$PtCl_6$]·2H_2O, (XI), (Zordan & Brammer, 2004), [BMIM]$_2$[$PtCl_6$], (XII), and [EMIM]$_2$[$PtCl_6$], (XIII), (Hasan *et al.*, 2001), {(DABCO)H_2[$PtCl_6$]}, (XIV), (Juan *et al.*, 1998), {*p*-C_6H_4(CH_2ImMe)$_2$[$PtCl_6$]}, (XV), (Li & Liu, 2003), [het][$PtCl_6$]·2H_2O, (XVI), (Hu *et al.*, 2003), [9-MeGuaH]$_2$ [$PtCl_6$]·2H_2O, (XVII), (Terzis & Mentzafos, 1983), [H_{10}[30]aneN_{10}] [$PtCl_6$]$_2$$Cl_6$·2$H_2O$, (XVIII), (Bencini *et al.*, 1992), [$H_2$$Me_2$ppz] [$PtCl_6$], (XIX), (Ciccarese *et al.*, 1998), [PA]$_2$[$PtCl_6$]Cl, (XX), (Delafontaine *et al.*, 1987), [DEA]$_2$[$PtCl_6$], (XXI), (Bokach *et al.*, 2003) and [HpyCl-3]$_3$[$PtCl_6$]Cl, (XXII), (Zordan *et al.*, 2005) [where hpy is halopyridinium, BMIM^+ is 1-*n*-butyl-3-methylimidazolium, EMIM^+ is 1-ethyl −3-methylimidazolium, DABCO is 1,4-diazabicyclooctane, Im is imidazolium, het is 2-(α-hydroxyethyl)thiamine, 9-MeGuaH is 9-methylguaninium, [H_{10}[30]aneN_{10}] is [$C_{20}H_{60}N_{10}$]$_{10+}$ cation, $H_2$$Me_2$ppz is *N*,*N*'-dimethylpiperazinium, PA is pentane-1,5-diammonium and DEA is diethyl- ammonium] have been synthesized and characterized by single-crystal X-ray diffraction methods. We report herein the synthesis and crystal structure of the title compound, (I).

The asymmetric unit of (I), (Fig. 1) contains one independent protonated 2,9-dimethyl-1,10-phenanthroline cation and one half $PtCl^{2-}_6$ anion. The Pt ion has an octahedral coordination (Table 1). In cation, the bond lengths and angles are in good agreement with the corresponding values in (VI) and (VII). In $PtCl^{2-}_6$ anion, the Pt—Cl bond lengths and Cl—Pt—Cl bond angles (Table 1) are also within normal ranges, as in (III) and (IV).

The intramolecular N—H···Cl and N—H···N hydrogen bonds (Table 2) seem to be effective in the stabilization of the structure.

Experimental

For the preparation of the title compound, (I), a solution of 2,9-dimethyl-1,10 -phenanthroline (0.31 g, 1.48 mmol) in methanol (10 ml) was added to a solution of H_2PtCl_6·6H_2O, (0.38 g, 0.74 mmol) in methanol (10 ml) at room temperature. The

suitable crystals for X-ray analysis were obtained by methanol diffusion in a solution of yellow precipitate in DMSO after one week (yield; 0.51 g, 83.4%).

Refinement

H atom (for NH) was located in difference syntheses and refined isotropically [N—H = 0.93 (7) Å and U_{iso}(H) = 0.021 (14) Å^2]. The remaining H atoms were positioned geometrically, with C—H = 0.93 and 0.96 Å, for aromatic and methyl H atoms and constrained to ride on their parent atoms, with U_{iso}(H) = 1.2U_{eq}(C).

Figures

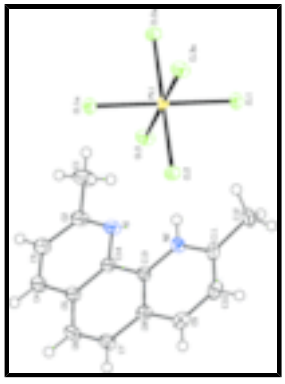


Fig. 1. The molecular structure of the title molecule, with the atom-numbering scheme. Displacement ellipsoids are drawn at the 50% probability level.

Bis(2,9-dimethyl-1,10-phenanthrolinium) hexachloridoplatinate(IV)

Crystal data

$(C_{14}H_{13}N_2)_2[PtCl_6]$	Z = 1
M_r = 826.31	F_{000} = 402
Triclinic, $P\overline{1}$	D_x = 1.862 Mg m^{-3}
Hall symbol: -P 1	Mo $K\alpha$ radiation λ = 0.71073 Å
a = 8.9617 (10) Å	Cell parameters from 4500 reflections
b = 9.2179 (10) Å	θ = 2.3–29.2º
c = 9.9930 (11) Å	μ = 5.33 mm^{-1}
α = 78.427 (9)º	T = 120 (2) K
β = 66.464 (8)º	Block, orange
γ = 79.540 (9)º	0.50 × 0.27 × 0.25 mm
V = 736.70 (14) Å^3	

Data collection

Stoe IPDSII diffractometer	3817 independent reflections
Radiation source: fine-focus sealed tube	3813 reflections with $I > 2\sigma(I)$
Monochromator: graphite	R_{int} = 0.073

Detector resolution: 0.15 mm pixels mm^{-1}

T = 120(2) K

rotation method scans

Absorption correction: numerical
(shape of crystal determined optically)

T_{min} = 0.195, T_{max} = 0.265

8112 measured reflections

θ_{max} = 29.2º

θ_{min} = 2.3º

h = −12→12

k = −11→12

l = −13→13

Refinement

Refinement on F^2

Least-squares matrix: full

$R[F^2 > 2\sigma(F^2)]$ = 0.037

$wR(F^2)$ = 0.100

S = 1.10

3817 reflections

183 parameters

Primary atom site location: structure-invariant direct methods

Secondary atom site location: difference Fourier map

Hydrogen site location: inferred from neighbouring sites

H atoms treated by a mixture of independent and constrained refinement

$w = 1/[\sigma^2(F_o^2) + (0.0772P)^2 + 0.2717P]$
where $P = (F_o^2 + 2F_c^2)/3$

$(\Delta/\sigma)_{max}$ = 0.015

$\Delta\rho_{max}$ = 2.93 e $Å^{-3}$

$\Delta\rho_{min}$ = −3.20 e $Å^{-3}$

Extinction correction: SHELXL,
$Fc^* = kFc[1+0.001xFc^2\lambda^3/\sin(2\theta)]^{-1/4}$

Extinction coefficient: 0.061 (6)

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 $F^2 > 2\text{sigma}(F^2)$ 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 ($Å^2$)

	x	*y*	*z*	U_{iso}*/U_{eq}
Pt1	0.0000	0.5000	0.0000	0.01485 (12)
Cl1	−0.24815 (12)	0.59692 (11)	−0.02163 (13)	0.0257 (2)
Cl2	−0.03063 (12)	0.26384 (11)	−0.02698 (12)	0.02210 (19)
Cl3	−0.13725 (14)	0.43950 (12)	0.25290 (11)	0.0255 (2)
N1	−0.2722 (5)	0.1814 (4)	0.5578 (4)	0.0221 (6)
N2	−0.3408 (4)	0.1347 (4)	0.3301 (4)	0.0205 (6)
H2	−0.349 (8)	0.228 (7)	0.356 (7)	0.021 (14)*
C1	−0.2682 (9)	0.3619 (6)	0.7008 (6)	0.0383 (12)

H1A	−0.3821	0.3974	0.7250	0.046*
H1B	−0.2035	0.4245	0.6157	0.046*
H1C	−0.2385	0.3644	0.7825	0.046*
C2	−0.2375 (6)	0.2055 (5)	0.6681 (5)	0.0254 (8)
C3	−0.1730 (6)	0.0873 (5)	0.7538 (5)	0.0254 (8)
H3	−0.1484	0.1082	0.8295	0.031*
C4	−0.1473 (6)	−0.0565 (5)	0.7255 (5)	0.0243 (8)
H4	−0.1068	−0.1338	0.7819	0.029*
C5	−0.1839 (5)	−0.0844 (5)	0.6073 (4)	0.0210 (7)
C6	−0.1628 (6)	−0.2299 (5)	0.5680 (5)	0.0244 (8)
H6	−0.1193	−0.3109	0.6186	0.029*
C7	−0.2057 (6)	−0.2517 (5)	0.4571 (5)	0.0238 (7)
H7	−0.1934	−0.3474	0.4347	0.029*
C8	−0.2693 (5)	−0.1287 (5)	0.3755 (4)	0.0203 (7)
C9	−0.3174 (5)	−0.1435 (5)	0.2607 (5)	0.0250 (8)
H9	−0.3103	−0.2373	0.2361	0.030*
C10	−0.3751 (5)	−0.0186 (6)	0.1850 (5)	0.0257 (8)
H10	−0.4069	−0.0288	0.1098	0.031*
C11	−0.3858 (5)	0.1233 (5)	0.2207 (5)	0.0228 (7)
C12	−0.4467 (6)	0.2634 (6)	0.1432 (5)	0.0288 (9)
H12A	−0.3630	0.3294	0.1003	0.035*
H12B	−0.5425	0.3111	0.2128	0.035*
H12C	−0.4738	0.2395	0.0671	0.035*
C13	−0.2848 (5)	0.0152 (4)	0.4093 (4)	0.0178 (6)
C14	−0.2458 (5)	0.0393 (4)	0.5291 (4)	0.0185 (7)

Atomic displacement parameters (Å^2)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
Pt1	0.01930 (15)	0.01366 (15)	0.01486 (14)	−0.00114 (7)	−0.01009 (9)	−0.00206 (7)
Cl1	0.0245 (4)	0.0221 (4)	0.0365 (5)	−0.0005 (3)	−0.0191 (4)	−0.0028 (4)
Cl2	0.0259 (4)	0.0170 (4)	0.0267 (5)	−0.0028 (3)	−0.0117 (4)	−0.0061 (3)
Cl3	0.0373 (5)	0.0220 (4)	0.0172 (4)	−0.0047 (4)	−0.0099 (4)	−0.0026 (3)
N1	0.0298 (17)	0.0175 (15)	0.0190 (15)	−0.0037 (12)	−0.0090 (13)	−0.0023 (12)
N2	0.0219 (15)	0.0207 (16)	0.0194 (15)	−0.0020 (12)	−0.0093 (12)	−0.0008 (12)
C1	0.072 (4)	0.020 (2)	0.029 (2)	−0.007 (2)	−0.025 (2)	−0.0055 (17)
C2	0.038 (2)	0.0199 (18)	0.0201 (18)	−0.0067 (15)	−0.0115 (17)	−0.0014 (14)
C3	0.036 (2)	0.025 (2)	0.0188 (17)	−0.0073 (16)	−0.0135 (16)	−0.0022 (15)
C4	0.034 (2)	0.0250 (19)	0.0174 (17)	−0.0060 (15)	−0.0140 (16)	0.0009 (14)
C5	0.0282 (18)	0.0202 (18)	0.0165 (16)	−0.0053 (14)	−0.0102 (14)	−0.0004 (13)
C6	0.032 (2)	0.0170 (17)	0.0227 (18)	−0.0015 (14)	−0.0115 (16)	0.0012 (14)
C7	0.033 (2)	0.0176 (17)	0.0222 (18)	−0.0003 (14)	−0.0122 (16)	−0.0044 (14)
C8	0.0226 (17)	0.0197 (17)	0.0192 (17)	−0.0024 (13)	−0.0076 (14)	−0.0050 (14)
C9	0.0238 (18)	0.028 (2)	0.0247 (19)	−0.0057 (15)	−0.0082 (16)	−0.0060 (16)
C10	0.0239 (18)	0.036 (2)	0.0210 (18)	−0.0054 (16)	−0.0100 (15)	−0.0068 (16)
C11	0.0170 (15)	0.031 (2)	0.0208 (18)	−0.0020 (14)	−0.0097 (14)	−0.0012 (15)
C12	0.0261 (19)	0.034 (2)	0.028 (2)	0.0002 (16)	−0.0165 (17)	0.0040 (17)
C13	0.0207 (16)	0.0188 (17)	0.0153 (15)	−0.0017 (12)	−0.0087 (13)	−0.0019 (12)

C14	0.0243 (17)	0.0177 (17)	0.0154 (15)	−0.0047 (13)	−0.0085 (13)	−0.0023 (13)

Geometric parameters (Å, °)

Pt1—Cl1	2.3184 (10)	C6—C7	1.369 (6)
Pt1—Cl1^{i}	2.3184 (10)	C6—H6	0.9300
Pt1—Cl2	2.3235 (9)	C7—C8	1.429 (6)
Pt1—Cl2^{i}	2.3235 (9)	C7—H7	0.9300
Pt1—Cl3^{i}	2.3263 (11)	C8—C13	1.403 (5)
Pt1—Cl3	2.3263 (11)	C8—C9	1.414 (6)
N2—H2	0.93 (7)	C9—C10	1.383 (7)
C1—C2	1.495 (6)	C9—H9	0.9300
C1—H1A	0.9600	C10—C11	1.400 (6)
C1—H1B	0.9600	C10—H10	0.9300
C1—H1C	0.9600	C11—N2	1.336 (5)
C2—N1	1.325 (6)	C11—C12	1.498 (6)
C2—C3	1.432 (6)	C12—H12A	0.9600
C3—C4	1.370 (6)	C12—H12B	0.9600
C3—H3	0.9300	C12—H12C	0.9600
C4—C5	1.426 (6)	C13—N2	1.364 (5)
C4—H4	0.9300	C13—C14	1.441 (5)
C5—C14	1.407 (6)	C14—N1	1.355 (5)
C5—C6	1.431 (6)		
Cl1—Pt1—Cl1^{i}	180	C7—C6—H6	119.5
Cl1—Pt1—Cl2	91.41 (4)	C5—C6—H6	119.5
Cl1^{i}—Pt1—Cl2	88.59 (4)	C6—C7—C8	120.6 (4)
Cl1—Pt1—Cl2^{i}	88.59 (4)	C6—C7—H7	119.7
Cl1^{i}—Pt1—Cl2^{i}	91.41 (4)	C8—C7—H7	119.7
Cl2—Pt1—Cl2^{i}	180	C13—C8—C9	117.6 (4)
Cl1—Pt1—Cl3^{i}	90.59 (4)	C13—C8—C7	118.9 (4)
Cl1^{i}—Pt1—Cl3^{i}	89.41 (4)	C9—C8—C7	123.5 (4)
Cl2—Pt1—Cl3^{i}	91.76 (4)	C10—C9—C8	120.0 (4)
Cl2^{i}—Pt1—Cl3^{i}	88.24 (4)	C10—C9—H9	120.0
Cl1—Pt1—Cl3	89.41 (4)	C8—C9—H9	120.0
Cl1^{i}—Pt1—Cl3	90.59 (4)	C9—C10—C11	120.5 (4)
Cl2—Pt1—Cl3	88.24 (4)	C9—C10—H10	119.7
Cl2^{i}—Pt1—Cl3	91.76 (4)	C11—C10—H10	119.7
Cl3^{i}—Pt1—Cl3	180	N2—C11—C10	118.5 (4)
C2—C1—H1A	109.5	N2—C11—C12	118.1 (4)
C2—C1—H1B	109.5	C10—C11—C12	123.4 (4)
H1A—C1—H1B	109.5	C11—C12—H12A	109.5
C2—C1—H1C	109.5	C11—C12—H12B	109.5
H1A—C1—H1C	109.5	H12A—C12—H12B	109.5
H1B—C1—H1C	109.5	C11—C12—H12C	109.5
N1—C2—C3	121.8 (4)	H12A—C12—H12C	109.5
N1—C2—C1	117.6 (4)	H12B—C12—H12C	109.5

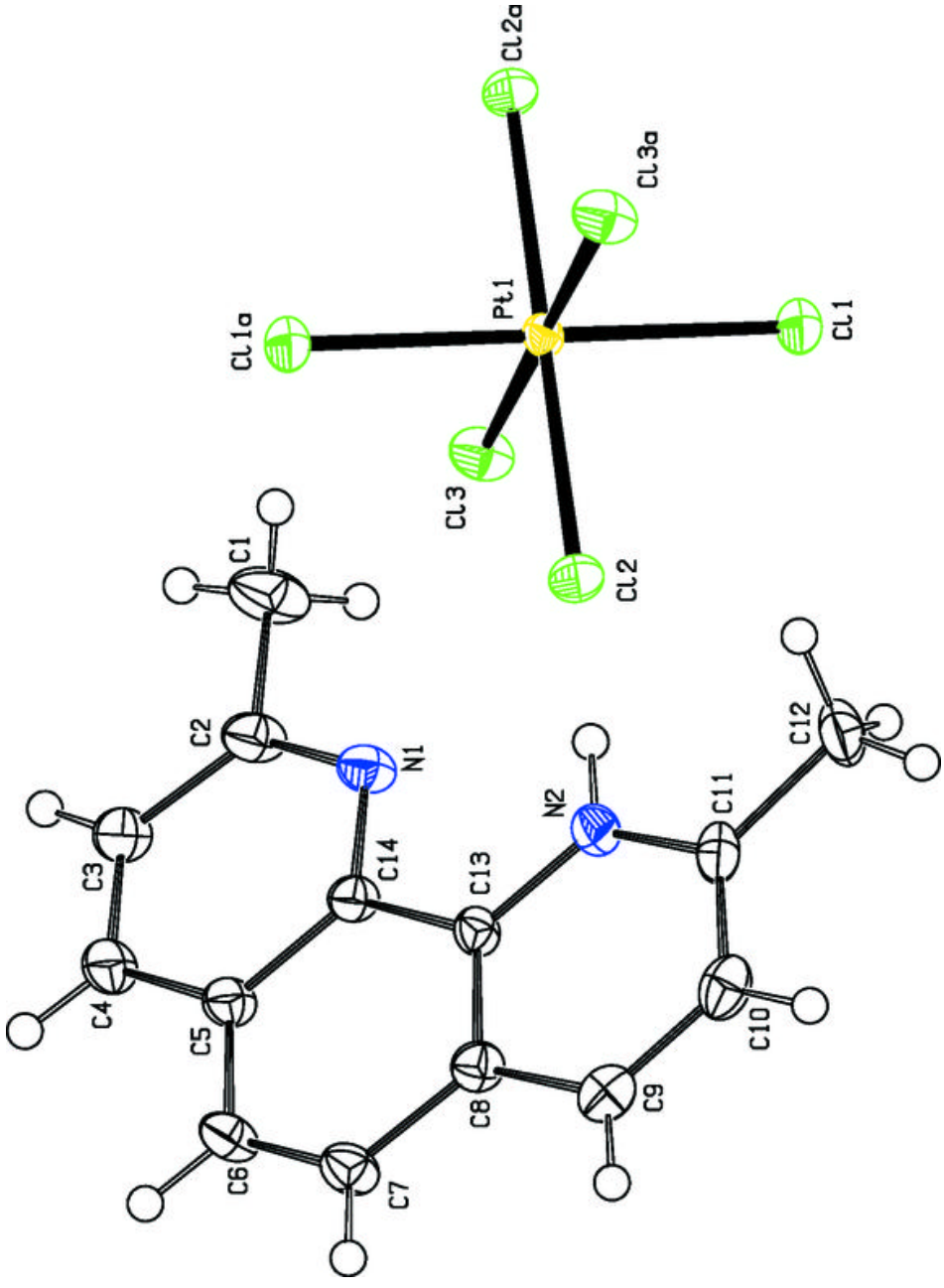
C3—C2—C1	120.5 (4)	N2—C13—C8	120.0 (4)
C4—C3—C2	120.6 (4)	N2—C13—C14	118.9 (3)
C4—C3—H3	119.7	C8—C13—C14	121.1 (4)
C2—C3—H3	119.7	N1—C14—C5	124.9 (4)
C3—C4—C5	118.3 (4)	N1—C14—C13	116.8 (4)
C3—C4—H4	120.9	C5—C14—C13	118.3 (4)
C5—C4—H4	120.9	C2—N1—C14	117.6 (4)
C14—C5—C4	116.8 (4)	C11—N2—C13	123.4 (4)
C14—C5—C6	120.0 (4)	C11—N2—H2	119 (4)
C4—C5—C6	123.3 (4)	C13—N2—H2	117 (4)
C7—C6—C5	121.0 (4)		
N1—C2—C3—C4	−1.0 (7)	C7—C8—C13—C14	−3.2 (6)
C1—C2—C3—C4	179.0 (5)	C4—C5—C14—N1	0.2 (6)
C2—C3—C4—C5	0.9 (7)	C6—C5—C14—N1	179.3 (4)
C3—C4—C5—C14	−0.5 (6)	C4—C5—C14—C13	−179.8 (4)
C3—C4—C5—C6	−179.6 (4)	C6—C5—C14—C13	−0.6 (6)
C14—C5—C6—C7	−1.6 (7)	N2—C13—C14—N1	1.8 (5)
C4—C5—C6—C7	177.5 (4)	C8—C13—C14—N1	−176.9 (4)
C5—C6—C7—C8	1.4 (7)	N2—C13—C14—C5	−178.3 (4)
C6—C7—C8—C13	0.9 (6)	C8—C13—C14—C5	3.1 (6)
C6—C7—C8—C9	−179.4 (4)	C3—C2—N1—C14	0.6 (7)
C13—C8—C9—C10	0.9 (6)	C1—C2—N1—C14	−179.4 (4)
C7—C8—C9—C10	−178.8 (4)	C5—C14—N1—C2	−0.2 (6)
C8—C9—C10—C11	0.2 (6)	C13—C14—N1—C2	179.8 (4)
C9—C10—C11—N2	−0.7 (6)	C10—C11—N2—C13	0.0 (6)
C9—C10—C11—C12	179.9 (4)	C12—C11—N2—C13	179.4 (4)
C9—C8—C13—N2	−1.6 (6)	C8—C13—N2—C11	1.2 (6)
C7—C8—C13—N2	178.1 (4)	C14—C13—N2—C11	−177.5 (4)
C9—C8—C13—C14	177.1 (4)		

Symmetry codes: (i) −*x*, −*y*+1, −*z*.

Hydrogen-bond geometry (Å, °)

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
N2—H2···Cl3	0.93 (7)	2.73 (7)	3.418 (4)	132 (5)
N2—H2···N1	0.93 (7)	2.32 (7)	2.711 (6)	105 (5)

Fig. 1


Cl2a
Cl3a
Pt1
Cl1a
Cl1
Cl3
Cl2
C1
C2
N1
C12
N2
C11
C14
C13
C3
C4
C5
C10
C8
C9
C6
C7