SUPPORTING INFORMATION

Ascorbic acid decomposition into oxalate ions: a simple synthetic route towards oxalato-bridged 3d-4f clusters

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Experimental Section

General

All starting materials, reagents, and solvents were purchased from commercial sources (Aldrich and Acros) and used without further purification.

Experimental procedures

Synthesis of the precursors and of the dodecanuclear $[M^{II}_6Ln^{III}_6]$ clusters

▪ The mononuclear precursor, $[M^{II}(valpn)(H_2O)]$, was prepared starting from 20 mL ethanol solution containing *o*-vanillin (0.030 g, 2 mmol) to which were added dropwise, under stirring 1,3-diaminopropane (0.07 g, 1 mmol) followed by triethylamine (0.020 g, 2 mmol). After 30 minutes, an aqueous solution (20 mL) containing 1 mmol of $M^{II}(O_2CCH_3)_2 \cdot xH_2O$, [$M^{II}$ = Cu^{II} (0.020 g), Ni^{II} (0.025 g) and Zn^{II} (0.022 g)] was added and the mixture and stirred for one hour. The green (for Cu^{II}), pale green (for Ni^{II}) and pale yellow (for Zn^{II}) solids obtained were then filtered and dried in air.

▪ To obtain the dodecanuclear $[M^{II}_6Ln^{III}_6]$ compounds, three solutions have been layered in a test tube. The bottom layer consisted of a solution obtained by dissolving 1 mmol $[M^{II}(valpn)(H_2O)]$ [0.040, 0.423 and 0.042 g of the Cu^{II}, Ni^{II} and Zn^{II} precursors] and 1 mmol of $Ln(OOCCH_3)_3 \cdot xH_2O$ in 10 mL dimethylformamide/methanol/water (1:1:1 v/v/v) mixture, the second layer consisted of 5 mL acetonitrile, while the top layer contained *L*-ascorbic acid (0.018 g, 1 mmol) and triethylamine (0.010 g, 1 mmol) dissolved in 10 mL of ethanol. The ascorbic acid solution was beforehand stirred at ~75°C for about 2 h. X-ray quality crystals were obtained by slow diffusion of the components after 1-2 weeks at room temperature.

Synthesis of $[\{L^1Ni^{II}_2Gd^{III}(H_2O)_4\}_2(C_2O_4)_3] \cdot 12H_2O$ (**7**)

To a warm methanolic solution (20 mL) of 2,6-di(acetoacetyl)pyridine[1] (0.031 g, 0.125 mmol) was added another methanolic solution (10 mL) containing $Ni(NO_3)_2 \cdot 6H_2O$ (0.036 g, 0.125 mmol) and $Gd(NO_3)_3 \cdot 6H_2O$ (0.028 g, 0.0625 mmol), followed by the addition of an aqueous solution (5 mL) of *L*-ascorbic acid (0.080 g, 0.454 mmol) and triethylamine (0.05 g, 5 mmol) and aditional water (5 mL). The reaction was continued at 60°C for one hour. The resulting solution was filtered warm and allowed to stand at room temperature. Suitable crystals for X-ray diffraction were obtained by slow evaporation of the solution within several days on standing at room temperature.

Physical measurements

X-ray diffraction measurements were performed on a STOE IPDS II diffractometer for **6** and Oxford-Diffraction XCALIBUR E CCD diffractometer for the rest compounds, both operating with Mo-Kα radiation. Single crystals were fixed at 70 mm (for STOE) and 40 mm (for XCALIBUR) from the detector and 281, 388, 151, 386, 226, 347 frames were measured each for 80, 80, 100, 80, 160, 30 s over 1° scan with for **1-5 and 7**, respectively. The unit cell determination and data integration were carried out using CrysAlis package of Oxford Diffraction.[1] The structures were solved by direct methods using Olex2[2] software with the SHELXS structure solution program and refined by full-matrix least-squares method on F^2 with SHELXL-97.[3] Atomic displacements for non-hydrogen atoms were refined using an anisotropic model. Hydrogen atoms were placed in fixed, idealized positions and refined as rigidly bonded to the corresponding carbon atoms. Hydrogen atoms for OH groups have been placed by Fourier Difference, accounting for the hybridization and the hydrogen bonds parameters. Crystallographic analysis has revealed all the structures to contain large accessible voids accommodating severally disordered solvate molecules. Since the attempts to locate and refine the positions of all disordered molecules, which filled the voids of possible solvent inclusion, in the crystal structure **1-5** were unsuccessful, the "*Use solvent mask routine*" subroutine available in Olex2 program was used to account for the scattering from the disordered solvent molecule.

A summary of the crystallographic data and the structure refinement for compounds **1-5**, **7** are given in **Table S1**. Selected bond lengths and angles for them are listed in **Table S2**. CCDC reference number: 1049546; 1049497; 1049498; 1049499; 1049500; 1049501. These data can be obtained free of charge from The Cambridge Crystallographic Data Centre via www.ccdc.cam.ac.uk/data_request/cif

1. CrysAlis RED, Oxford Diffraction Ltd., Version 1.171.36.32, **2003**.

2. O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, A. K. J. Howard and H. Puschmann, OLEX2: a complete structure solution, refinement and analysis program. *J. Appl. Cryst.*, 2009, **42**, 339.

3. G. M. Sheldrick, SHELXS, *Acta Cryst.*, 2008, **A64**, 112.

Direct current (dc) magnetic susceptibility measurements on crushed crystals of **1**, **4** and **6** (mixed with grease to avoid the crystallite orientation) were performed with a Quantum Design MPMS-XL SQUID magnetometer in the temperature range 1.9-300 K and under applied magnetic fields of 5000G ($T > 50$ K) and 100 G ($1.9 \leq T \leq 50$ K). The magnetic susceptibility data were corrected for the diamagnetic contribution of the constituent atoms. Corrections for the temperature-independent paramagnetism and sample holder (a plastic bag) were also applied.

The IR spectra were recorded on KBr pellets on a JASCO FTIR 4100 spectrophotometer in the 4000-400 cm^{-1} range. Selected IR data (KBr, cm^{-1}):

1 3372 (m), 2924 (w), 2853 (w), 1657 (s), 1639 (s), 1573 (m), 1474 (m), 1439 (m), 1410 (m), 1364 (m), 1311 (m), 1241 (m), 1223 (m), 1169 (m), 1097 (m), 1071 (m), 1025 (m), 979 (m), 953 (w), 906 (w), 856 (w).

2 3419 (m), 3062 (w), 2931 (w), 1627 (s), 1571 (m), 1475 (m), 1454 (m), 1412 (m), 1369 (m), 1315 (m), 1227 (m), 1169 (w), 1103 (w), 1076 (m), 1005 (w), 987 (w), 951 (w), 855 (w).

3 3422 (m), 3060 (w), 2929 (w), 2850 (w), 1627 (s), 1562 (m), 1475 (m), 1455 (m), 1413 (m), 1359 (w), 1315 (m), 1228 (m), 1169 (w), 1102 (m), 1075 (w), 1031 (w), 988 (w), 950 (w), 900 (w), 855 (w).

4 3427 (m), 3062 (w), 2933 (m), 2846 (w), 1649 (s), 1626 (s), 1571 (s), 1476 (m), 1412 (w), 1362 (w), 1314 (w), 1244 (m), 1228 (s), 1170 (m), 1099 (w), 1072 (m), 1006 (w), 975 (w), 952 (w), 855 (w).

5 3425 (m), 3061 (w), 2931 (w), 2848 (w), 1642 (s), 1574 (m), 1476 (m), 1412 (m), 1362 (m), 1307 (m), 1241 (s), 1222 (w), 1170 (w), 1098 (w), 1067 (m), 1003 (w), 973 (w), 949 (w), 919 (w), 852 (w).

6 3434 (m), 3061 (w), 2933 (w), 1647 (s), 1578 (m), 1478 (m), 1412 (m), 1361 (w), 1308 (m), 1242 (m), 1223 (m), 1171 (w), 1098 (w), 1068 (w), 974 (w), 951 (w), 853 (w).

7 3465(m), 3025(m), 2995(m), 2980(m), 2928(m), 1739(s), 1701(s), 1672(s), 1535(m), 1497(s), 1368(s), 1318(s), 1233(s), 1120 (w), 1001 (w), 951 (w), 802 (w).

Elemental analyses were performed on a EuroEA Elemental Analyser. Calcd. for: **1** $C_{150}H_{173.4}Dy_6Ni_6N_{12}O_{68.70}$: C, 39.42; H, 3.82; N, 3.68 %. Found: C, 39.24; H, 3.79; N, 3.40 %. **2** $C_{138}H_{138}Eu_6Cu_6N_{12}O_{62}$: C, 39.00; H, 3.27; N, 3.96 %. Found: C, 39.17; H, 3.24; N, 3.97 %. **3** $C_{140.1}H_{159.9}Gd_6Cu_6N_{12.7}O_{69.7}$: C, 37.71; H, 3.61; N, 3.99 %. Found: C, 38.04; H, 3.15; N, 4.02 %. **4** $C_{138}H_{148}Dy_6Cu_6N_{12}O_{65}$: C, 37.92; H, 3.41; N, 3.85 %. Found: C, 38.08; H, 3.38; N, 3.86 %. **5** $C_{141}H_{165.6}Eu_6Zn_6N_{12}O_{71.3}$: C, 37.86; H, 3.73; N, 3.76 %. Found: C, 38.01; H, 3.70; N, 3.77 %. **6** $C_{143.5}H_{172.2}Dy_6Zn_6N_{12}O_{71.6}$: C, 37.65; H,

3.79; N, 3.67 %. Found: C, 37.83; H, 3.68; N, 3.69 %. **7** $C_{58}H_{108}Gd_2Ni_4N_4O_{60}$: C, 29.38; H, 4.59; N, 2.36 %. Found: C, 29.84; H, 4.49; N, 2.40 %.

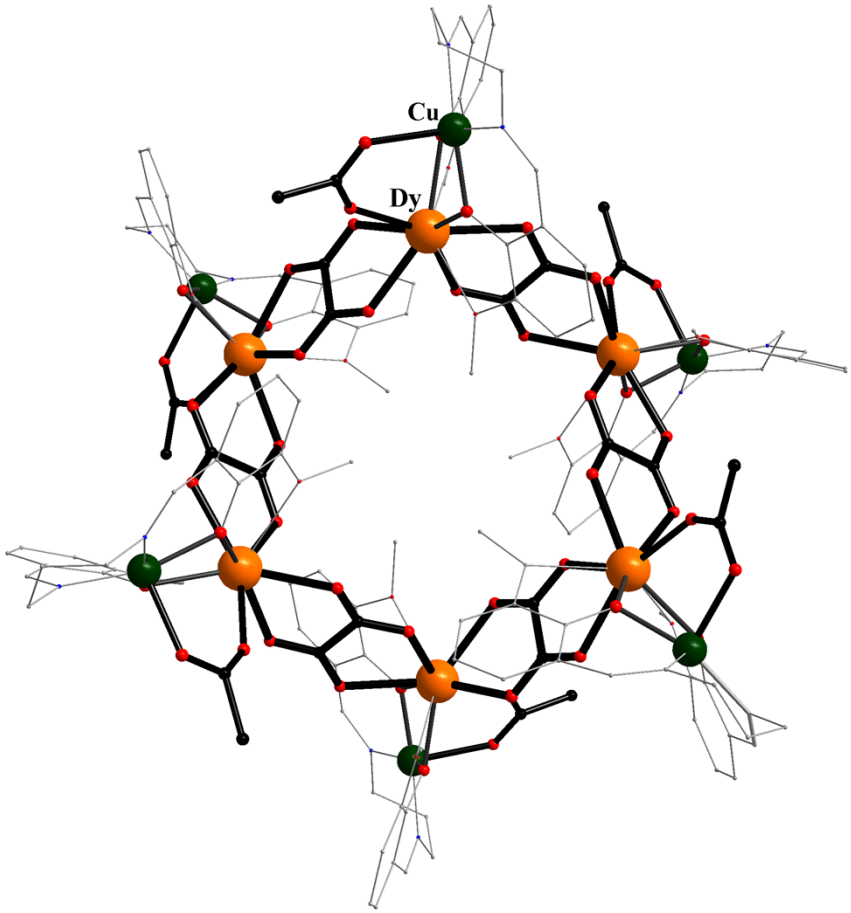

Figure S1. Perspective view of the dodecanuclear compound **4.** Colour code: dark green, orange, red, blue and grey stand for copper, dysprosium, oxygen, nitrogen and carbon, respectively.

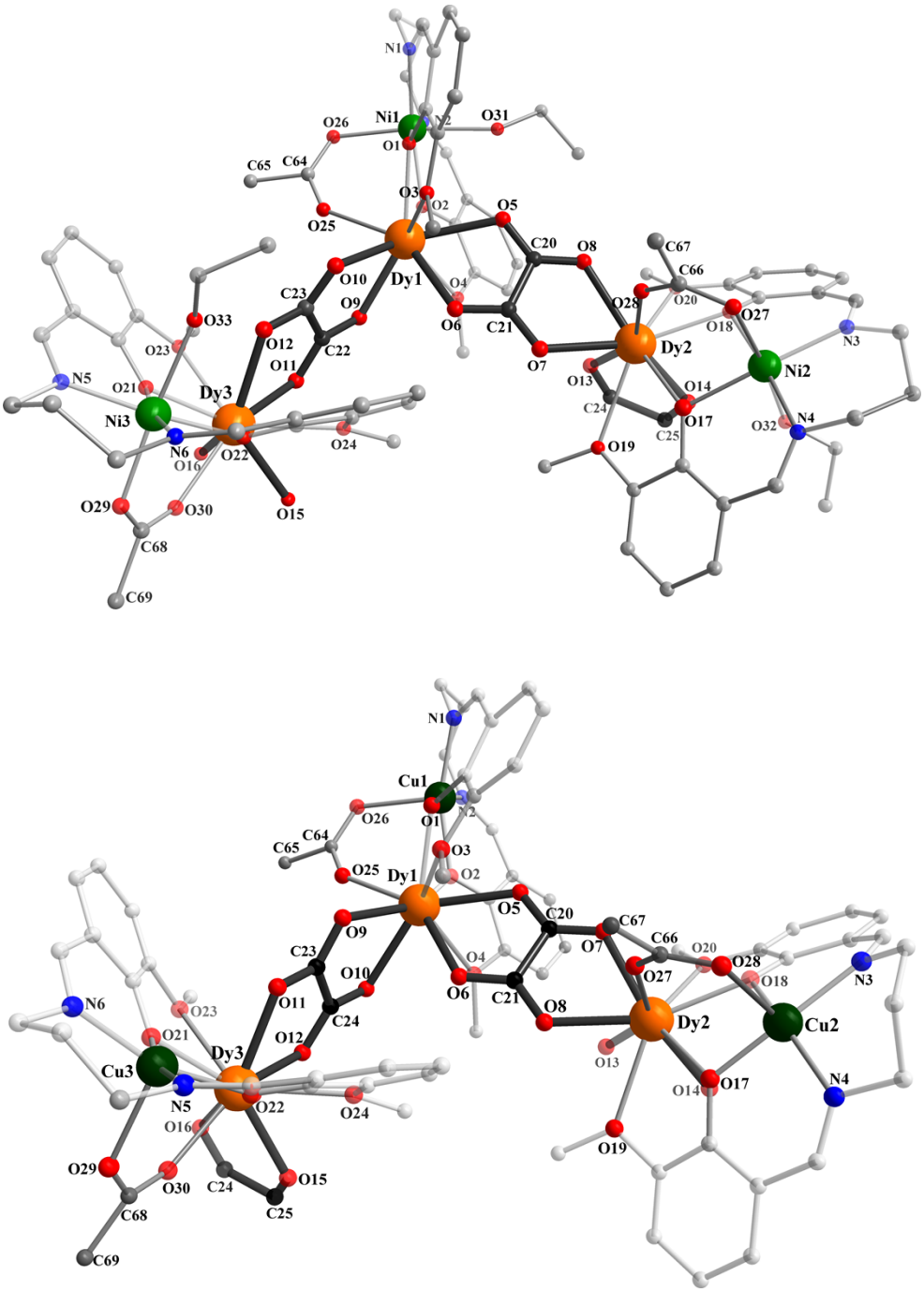

Figure S2. The asymmetric units for compounds **1** and **4.**

Table S1. Crystallographic data, details of data collection and structure refinement parameters for **1**-**5**, and **7**

Compound	**1**	**2**	**3**	**4**	**5**	**7**
Chemical formula	$C_{150}H_{173.4}Dy_6Ni_6N_{13}O_{68.7}$	$C_{138}H_{138}Cu_6Eu_6N_{12}O_{62}$	$C_{140.1}H_{160.9}Cu_6Gd_6N_{12.7}O_{69.7}$	$C_{138}H_{148}Cu_6Dy_6N_{12}O_{65}$	$C_{141}H_{165.6}Eu_6Zn_6N_{13}O_{71.3}$	$C_{29}H_{54}GdNi_2N_2O_{30}$
M/g mol^{-1}	4584.88	4249.60	4462.66	4370.92	4487.25	1185.41
Temp./K	173	173	173	173	173	293
Crystal system	Monoclinic	Triclinic	Triclinic	Triclinic	Monoclinic	Monoclinic
Space group	$P2_1/n$	P-1	P-1	P-1	$P2_1/n$	$C2/c$
a/Å	15.1001(6)	15.1982(12)	15.1096(4)	15.0763(4)	15.33521(11)	28.0665(17)
b/Å	27.9469(9)	18.9472(12)	18.9651(5)	18.9062(6)	26.8468(17)	17.0913(6)
c/Å	25.5495(7)	19.5041(13)	19.3767(6)	19.3431(6)	24.981(2)	23.7331(11)
α/°)	90.00	116.336(6)	116.117(3)	116.101(3)	90.00	90.00
β/°	93.399(8)	100.484(6)	100.924(2)	100.935(3)	91.157(7)	121.230(6)
γ/°	90.00	93.871(6)	92.814(2)	92.943(2)	90.00	90.00
V/Å^3	10763.0(6)	4879.0(6)	4839.6(2)	4804.2(3)	10293.7(13)	9734.9(8)
Z	2	1	1	1	2	8
D_c/g cm^{-3}	1.419	1.446	1.531	1.511	1.448	1.618
μ/mm^{-1}	2.648	2.611	2.750	3.029	2.562	2.204
Crystal size/mm^3	0.10 × 0.10 × 0.20	0.10 × 0.1 × 0.15	0.10 × 0.10 × 0.10	0.10 × 0.10 × 0.15	0.04 × 0.04 × 0.10	0.15 × 0.20 × 0.40
$\theta_{min,}$ θ_{max}/°	5.34 to 49.42	4.14 to 46.52	3.6 to 50.06	3.6 to 46.52	5.12 to 52.74	5.0 to 52.74
Reflections collected	62652	42206	45414	42447	47068	32135
Independent reflections	18236 [R_{int} = 0.1049]	13870 [R_{int} = 0.0711]	16972 [R_{int} = 0.0710]	13698 [R_{int} = 0.0605]	20931 [R_{int} = 0.1549]	9957 [R_{int} = 0.1166]
Data/restraints/ parameters	18236/65/1101	13870/18/1021	16972/7/1067	13698/19/1035	20931/58/927	9957/0/578
R_1[a] [(I > 2σ(I)]	0.0710	0.0766	0.0659	0.0583	0.0864	0.0830
wR_2[b] (all data)	0.1207	0.2144	0.1494	0.1551	0.1376	0.2113
GOF[c]	1.005	1.023	1.006	1.000	0.824	1.029
Largest diff. peak and hole/e·Å^{-3}	1.75/-1.29	2.47/-1.35	1.69/-0.90	1.98/-1.03	2.04/-1.13	0.96/-0.80

[a] $R_1 = \Sigma||F_o| - |F_c||/\Sigma|F_o|$, [b] $wR_2 = \{\Sigma[w\,(F_o^2 - F_c^2)^2]/\Sigma[w(F_o^2)^2]\}^{1/2}$. [c] GOF = $\{\Sigma[w(F_o^2 - F_c^2)^2]/(n-p)\}^{1/2}$, where n is the number of reflections and p is the total number of parameters refined.

Unit cell for compound **6**: Monoclinic $P2_1/n$, a = 15.1130(3), b = 26.5550(4), c = 24.6138(5), β/° = 90.858(6).

Tables S2. Bond lengths (Å) and angles (deg) for **1**-**5**, **7**

Bond lengths (Å)					
1	**2**	**3**	**4**	**5**	**7**
Ni1-N1 = 2.028(17)	Cu1-N1 = 1.93(2)	Cu1-N1 = 1.995(9)	Cu1-N1 = 1.956(12)	N1-Zn1 = 1.939(14)	Ni1-O1W = 2.049(8)
Ni1-N2 = 1.984(14)	Cu1-N2 = 1.981(16)	Cu1-N2 = 1.963(8)	Cu1-N2 = 1.988(10)	N2-Zn1 = 2.082(15)	Ni1-O2W = 2.070(7)
Ni1-O1 = 2.024(8)	Cu1-O1 = 1.997(10)	Cu1-O1 = 1.940(6)	Cu1-O1 = 1.983(8)	O1-Zn1 = 2.056(9)	Ni1-O3 = 2.032(7)
Ni1-O2 = 2.045(9)	Cu1-O2 = 1.973(12)	Cu1-O2 = 1.978(7)	Cu1-O2 = 1.963(9)	O2-Zn1 = 2.073(8)	Ni1-O4 = 1.986(7)
Ni1-O26 = 2.073(13)	Cu1-O26 = 2.185(13)	Cu1-O26 = 2.171(6)	Cu1-O26 = 2.172(10)	O26-Zn1 = 1.957(9)	Ni1-O5 = 1.993(8)
Ni1-O31 = 2.153(12)	Cu2-N3 = 1.963(14)	Cu2-N3 = 1.953(10)	Cu2-N3 = 1.963(11)	N3-Zn2 = 2.112(11)	Ni1-O6 = 2.009(7)
Ni2-N3 = 2.036(11)	Cu2-N4 = 1.980(16)	Cu2-N4 = 1.956(10)	Cu2-N4 = 1.981(11)	N4-Zn2 = 2.046(11)	Ni2-O1 = 2.002(7)
Ni2-N4 = 1.995(12)	Cu2-O17 = 1.981(11)	Cu2-O17 = 1.983(6)	Cu2-O17 = 1.930(8)	O17-Zn2 = 2.090(8)	Ni2-O2 = 2.004(6)
Ni2-O17 = 2.047(8)	Cu2-O18 = 1.957(10)	Cu2-O18 = 1.960(7)	Cu2-O18 = 1.974(8)	O18-Zn2 = 2.084(8)	Ni2-O3W = 2.039(8)
Ni2-O18 = 2.024(8)	Cu2-O28 = 2.197(12)	Cu2-O27 = 2.195(8)	Cu2-O27 = 2.171(9)	O27-Zn2 = 2.027(9)	Ni2-O4W = 2.121(8)
Ni2-O27 = 2.059(8)	Cu3-N5 = 1.983(19)	Cu3-N5 = 1.976(10)	Cu3-N5 = 1.981(13)	N5-Zn3 = 2.064(11)	Ni2-O7 = 2.035(7)
Ni2-O32 = 2.203(7)	Cu3-N6 = 1.986(18)	Cu3-N6 = 1.985(9)	Cu3-N6 = 1.983(12)	N6-Zn3 = 2.123(11)	Ni2-O8 = 2.000(7)
Ni3-N5 = 2.019(11)	Cu3-O21 = 1.944(13)	Cu3-O21 = 1.971(7)	Cu3-O21 = 1.974(9)	O21-Zn3 = 2.103(7)	
Ni3-N6 = 2.026(13)	Cu3-O22 = 2.002(11)	Cu3-O22 = 1.987(7)	Cu3-O22 = 2.004(9)	O22-Zn3 = 2.029(8)	Gd1-O2 = 2.503(6)
Ni3-O21 = 2.050(9)	Cu3-O30 = 2.188(14)	Cu3-O29 = 2.172(7)	Cu3-O29 = 2.176(11)	O29-Zn3 = 1.971(9)	Gd1-O3 = 2.501(6)
Ni3-O22 = 2.043(8)					Gd1-O6 = 2.534(7)
Ni3-O29 = 2.061(10)	Eu1-O1 = 2.386(11)	Gd1-O1 = 2.376(6)	Dy1-O1 = 2.349(9)	Eu1-O1 = 2.353(10)	Gd1-O7 = 2.522(6)
Ni3-O33 = 2.164(9)	Eu1-O2 = 2.400(10)	Gd1-O2 = 2.354(6)	Dy1-O2 = 2.371(8)	Eu1-O2 = 2.298(9)	Gd1-O9 = 2.438(7)
	Eu1-O3 = 2.632(11)	Gd1-O3 = 2.581(6)	Dy1-O3 = 2.620(8)	Eu1-O3 = 2.668(9)	Gd1-O10 = 2.444(7)
Dy1-O1 = 2.340(9)	Eu1-O4 = 2.640(12)	Gd1-O4 = 2.635(6)	Dy1-O4 = 2.631(8)	Eu1-O4 = 2.599(9)	Gd1-O13 = 2.518(7)
Dy1-O2 = 2.322(9)	Eu1-O5 = 2.416(11)	Gd1-O5 = 2.442(7)	Dy1-O5 = 2.395(9)	Eu1-O5 = 2.415(7)	Gd1-O14 = 2.494(7)
Dy1-O3 = 2.670(8)	Eu1-O6 = 2.414(10)	Gd1-O6 = 2.385(7)	Dy1-O6 = 2.351(8)	Eu1-O6 = 2.412(7)	Gd1-N1 = 2.649(8)
Dy1-O4 = 2.643(9)	Eu1-O9 = 2.456(9)	Gd1-O9 = 2.362(6)	Dy1-O9 = 2.359(8)	Eu1-O9 = 2.451(8)	Gd1-N2 = 2.679(8)
Dy1-O5 = 2.413(8)	Eu1-O10 = 2.393(11)	Gd1-O10 = 2.408(6)	Dy1-O10 = 2.418(7)	Eu1-O10 = 2.399(8)	
Dy1-O6 = 2.335(8)	Eu1-O25 = 2.335(11)	Gd1-O25 = 2.371(7)	Dy1-O25 = 2.332(9)	Eu1-O25 = 2.379(8)	
Dy1-O9 = 2.370(8)	Eu2-O7 = 2.392(10)	Gd2-O7 = 2.421(6)	Dy2-O7 = 2.375(8)	Eu2-O7 = 2.436(8)	
Dy1-O10 = 2.387(8)	Eu2-O8 = 2.413(10)	Gd2-O8 = 2.402(7)	Dy2-O8 = 2.391(9)	Eu2-O8 = 2.433(8)	

Dy1-O25 = 2.329(10)	Eu2-O13 = 2.405(11)	Gd2-O13 = 2.394(7)	Dy2-O13 = 2.348(8)	Eu2-O13 = 2.394(9)
Dy2-O7 = 2.363(8)	Eu2-O14 = 2.467(11)	Gd2-O14 = 2.424(7)	Dy2-O14 = 2.413(8)	Eu2-O14 = 2.425(9)
Dy2-O8 = 2.370(7)	Eu2-O17 = 2.376(11)	Gd2-O17 = 2.384(7)	Dy2-O17 = 2.359(7)	Eu2-O17 = 2.422(8)
Dy2-O13 = 2.366(8)	Eu2-O18 = 2.392(11)	Gd2-O18 = 2.393(6)	Dy2-O18 = 2.339(8)	Eu2-O18 = 2.424(7)
Dy2-O14 = 2.434(7)	Eu2-O19 = 2.652(11)	Gd2-O19 = 2.625(6)	Dy2-O19 = 2.571(8)	Eu2-O19 = 2.610(11)
Dy2-O17 = 2.280(9)	Eu2-O20 = 2.596(10)	Gd2-O20 = 2.592(7)	Dy2-O20 = 2.625(9)	Eu2-O20 = 2.616(8)
Dy2-O8 = 2.370(7)	Eu2-O27 = 2.362(12)	Gd2-O28 = 2.354(7)	Dy2-O28 = 2.344(8)	Eu2-O28 = 2.423(10)
Dy2-O19 = 2.647(8)	Eu3-O11 = 2.382(11)	Gd3-O11 = 2.387(7)	Dy3-O11 = 2.390(8)	Eu3-O11 = 2.418(8)
Dy2-O20 = 2.635(9)	Eu3-O12 = 2.428(10)	Gd3-O12 = 2.406(6)	Dy3-O12 = 2.357(9)	Eu3-O12 = 2.369(8)
Dy2-O28 = 2.327(8)	Eu3-O15 = 2.429(12)	Gd3-O15 = 2.378(6)	Dy3-O15 = 2.406(8)	Eu3-O15 = 2.430(9)
Dy3-O11 = 2.353(9)	Eu3-O16 = 2.384(10)	Gd3-O16 = 2.429(6)	Dy3-O16 = 2.369(8)	Eu3-O16 = 2.397(10)
Dy3-O12 = 2.406(8)	Eu3-O21 = 2.399(10)	Gd3-O21 = 2.395(6)	Dy3-O21 = 2.367(8)	Eu3-O21 = 2.351(8)
Dy3-O15 = 2.400(8)	Eu3-O22 = 2.399(12)	Gd3-O22 = 2.367(6)	Dy3-O22 = 2.373(9)	Eu3-O22 = 2.421(9)
Dy3-O16 = 2.386(7)	Eu3-O23 = 2.590(12)	Gd3-O23 = 2.631(7)	Dy3-O23 = 2.551(9)	Eu3-O23 = 2.655(8)
Dy3-O21 = 2.343(8)	Eu3-O24 = 2.656(12)	Gd3-O24 = 2.614(7)	Dy3-O24 = 2.632(9)	Eu3-O24 = 2.586(8)
Dy3-O22 = 2.326(9)	Eu3-O29 = 2.353(11)	Gd3-O30 = 2.364(7)	Dy3-O30 = 2.310(9)	Eu3-O30 = 2.424(8)
Dy3-O23 = 2.645(9)				
Dy3-O24 = 2.653(8)				
Dy3-O30 = 2.351(9)				

Angles (deg)					
1	**2**	**3**	**4**	**5**	**7**
O1-Ni1-O31 = 84.2(4)	N1-Cu1-N2 = 91.4(8)	N1-Cu1-O26 = 106.0(3)	N1-Cu1-N2 = 91.8(5)	N1-Zn1-N2 = 91.9(6)	O1W-Ni1-O2W = 177.9(3)
O1-Ni1-O2 = 86.5(3)	N1-Cu1-O1 = 89.4(7)	N2-Cu1-N1 = 92.8(4)	N1-Cu1-O1 = 89.2(4)	N1-Zn1-O1 = 86.6(5)	O3-Ni1-O1W = 91.4(3)
O1-Ni1-O26 = 91.0(4)	N1-Cu1-O2 = 166.4(7)	N2-Cu1-O2 = 90.3(3)	N1-Cu1-O2 = 167.5(4)	N1-Zn1-O2 = 149.2(5)	O3-Ni1-O2W = 90.4(3)
O1-Ni1-N1 = 87.3(5)	N1-Cu1-O26 = 95.7(7)	N2-Cu1-O26 = 94.5(3)	N1-Cu1-O26 = 94.7(5)	O1-Zn1-N2 = 152.1(4)	O4-Ni1-O1W = 89.0(3)
O2-Ni1-O31 = 83.1(4)	N2-Cu1-O1 = 162.4(6)	O1-Cu1-N1 = 91.3(3)	N2-Cu1-O26 = 106.7(4)	O1-Zn1-O2 = 78.0(4)	O4-Ni1-O2W = 91.9(3)
O2-Ni1-O26 = 92.0(5)	N2-Cu1-O26 = 105.6(6)	O1-Cu1-N2 = 170.4(3)	O1-Cu1-N2 = 161.5(5)	O2-Zn1-N2 = 89.6(4)	O4-Ni1-O3 = 93.6(3)
N2-Ni1-O31 = 91.5(6)	O1-Cu1-O26 = 91.8(5)	O1-Cu1-O2 = 82.2(3)	O1-Cu1-O26 = 91.6(4)	O26-Zn1-N1 = 107.1(5)	O4-Ni1-O5 = 90.1(3)
N2-Ni1-O1 = 174.4(6)	O2-Cu1-N2 = 90.6(7)	O1-Cu1-O26 = 92.7(3)	O2-Cu1-N2 = 90.9(4)	O26-Zn1-N2 = 104.5(5)	O4-Ni1-O6 = 175.1(3)
N2-Ni1-O2 = 89.4(6)	O2-Cu1-O1 = 84.7(4)	O2-Cu1-N1 = 154.6(3)	O2-Cu1-O1 = 84.4(3)	O26-Zn1-O1 = 102.5(4)	O5-Ni1-O1W = 89.4(3)
N2-Ni1-O26 = 92.9(6)	O2-Cu1-O26 = 96.7(5)	O2-Cu1-O26 = 98.9(3)	O2-Cu1-O26 = 96.3(4)	O26-Zn1-O2 = 102.3(4)	O5-Ni1-O2W = 88.8(3)
N2-Ni1-N1 = 96.5(7)	N3-Cu2-N4 = 93.4(7)	N3-Cu2-N4 = 93.0(4)	N3-Cu2-N4 = 93.5(5)	N4-Zn2-N3 = 94.9(5)	O5-Ni1-O3 = 176.2(3)
O26-Ni1-O31 = 173.4(4)	N3-Cu2-O17 = 90.0(6)	N3-Cu2-O17 = 161.8(4)	N3-Cu2-O18 = 89.6(4)	N4-Zn2-O17 = 86.3(4)	O5-Ni1-O6 = 94.5(3)
N1-Ni1-O31 = 90.4(6)	N3-Cu2-O28 = 93.7(6)	N3-Cu2-O18 = 89.7(4)	N3-Cu2-O27 = 95.0(4)	N4-Zn2-O18 = 156.3(5)	O6-Ni1-O1W = 89.6(3)
N1-Ni1-O2 = 171.5(5)	N4-Cu2-O17 = 152.2(6)	N3-Cu2-O27 = 103.9(4)	N4-Cu2-O27 = 106.4(4)	O17-Zn2-N3 = 154.7(4)	O6-Ni1-O2W = 89.6(3)
N1-Ni1-O26 = 93.9(6)	N4-Cu2-O28 = 107.9(5)	N4-Cu2-O17 = 90.1(3)	O17-Cu2-N3 = 170.1(4)	O18-Zn2-N3 = 85.4(4)	O6-Ni1-O3 = 81.8(3)
N3-Ni2-O17 = 170.8(4)	O17-Cu2-O28 = 99.4(5)	N4-Cu2-O18 = 167.7(4)	O17-Cu2-N4 = 91.4(4)	O18-Zn2-O17 = 83.7(3)	O1-Ni2-O2 = 93.8(3)
N3-Ni2-O32 = 89.8(4)	O18-Cu2-N3 = 171.1(6)	N4-Cu2-O27 = 97.2(4)	O17-Cu2-O18 = 82.3(3)	O27-Zn2-N3 = 107.1(4)	O1-Ni2-O3W = 92.0(3)
N3-Ni2-O27 = 95.1(4)	O18-Cu2-N4 = 90.9(5)	O17-Cu2-O27 = 93.4(3)	O17-Cu2-O27 = 91.9(3)	O27-Zn2-N4 = 101.6(5)	O1-Ni2-O4W = 87.7(3)
O18-Ni2-N3 = 89.5(4)	O18-Cu2-O17 = 82.6(4)	O18-Cu2-O17 = 83.7(3)	O18-Cu2-N4 = 155.0(4)	O27-Zn2-O17 = 97.3(4)	O1-Ni2-O7 = 172.5(3)
O18-Ni2-O17 = 83.1(3)	O18-Cu2-O28 = 92.4(4)	O18-Cu2-O27 = 93.8(3)	O18-Cu2-O27 = 98.0(3)	O27-Zn2-O18 = 101.0(4)	O2-Ni2-O3W = 86.8(3)
O18-Ni2-O32 = 80.4(3)	N5-Cu3-N6 = 94.7(8)	N5-Cu3-N6 = 92.1(4)	N5-Cu3-N6 = 93.5(5)	N5-Zn3-N6 = 90.8(5)	O2-Ni2-O4W = 91.6(3)
O18-Ni2-O27 = 92.3(3)	N5-Cu3-O22 = 89.0(6)	N5-Cu3-O22 = 89.2(3)	N5-Cu3-O22 = 89.6(5)	N5-Zn3-O21 = 87.9(4)	O2-Ni2-O7 = 81.8(3)
O17-Ni2-O32 = 83.5(3)	N5-Cu3-O30 = 96.4(6)	N5-Cu3-O29 = 95.0(3)	N5-Cu3-O29 = 97.3(5)	O21-Zn3-N6 = 156.1(4)	O3W-Ni2-O4W = 178.4(3)
O17-Ni2-O27 = 90.7(3)	N6-Cu3-O22 = 162.0(8)	N6-Cu3-O22 = 161.0(3)	N6-Cu3-O22 = 161.2(5)	O22-Zn3-N5 = 149.1(4)	O7-Ni2-O3W = 93.7(3)
N4-Ni2-N3 = 95.9(5)	N6-Cu3-O30 = 103.2(8)	N6-Cu3-O29 = 107.1(3)	N6-Cu3-O29 = 103.6(5)	O22-Zn3-N6 = 89.3(4)	O7-Ni2-O4W = 86.5(3)
N4-Ni2-O18 = 171.8(4)	O21-Cu3-N5 = 167.5(6)	O21-Cu3-N5 = 167.2(3)	O21-Cu3-N5 = 167.5(5)	O22-Zn3-O21 = 79.9(3)	O8-Ni2-O1 = 91.8(3)
N4-Ni2-O17 = 90.9(4)	O21-Cu3-N6 = 89.6(7)	O21-Cu3-N6 = 90.2(3)	O21-Cu3-N6 = 89.7(5)	O29-Zn3-N5 = 107.5(4)	O8-Ni2-O2 = 174.0(3)
N4-Ni2-O32 = 93.4(4)	O21-Cu3-O22 = 83.4(5)	O21-Cu3-O22 = 84.7(3)	O21-Cu3-O22 = 83.6(4)	O29-Zn3-N6 = 104.4(4)	O8-Ni2-O3W = 90.7(3)
N4-Ni2-O27 = 93.3(4)	O21-Cu3-O30 = 94.0(5)	O21-Cu3-O29 = 96.4(3)	O21-Cu3-O29 = 93.7(4)	O29-Zn3-O21 = 98.7(4)	O8-Ni2-O4W = 90.9(3)
O27-Ni2-O32 = 171.2(4)	O22-Cu3-O30 = 93.9(5)	O22-Cu3-O29 = 91.7(3)	O22-Cu3-O29 = 94.4(4)	O29-Zn3-O22 = 102.3(4)	O8-Ni2-O7 = 92.9(3)
O22-Ni3-O21 = 86.1(3)					
O22-Ni3-O29 = 91.0(4)	O1-Eu1-O2 = 68.0(4)	O1-Gd1-O3 = 62.5(2)	O1-Dy1-O2 = 68.3(3)	O1-Eu1-O3 = 63.6(3)	O2-Gd1-O6 = 158.2(2)
O22-Ni3-O33 = 83.7(3)	O1-Eu1-O3 = 61.5(3)	O1-Gd1-O4 = 120.8(2)	O1-Dy1-O3 = 62.2(3)	O1-Eu1-O4 = 126.3(3)	O2-Gd1-O7 = 63.5(2)
O21-Ni3-O29 = 89.8(4)	O1-Eu1-O4 = 123.5(3)	O1-Gd1-O5 = 75.1(2)	O1-Dy1-O4 = 124.6(3)	O1-Eu1-O5 = 77.9(3)	O2-Gd1-O13 = 92.0(2)
O21-Ni3-O33 = 85.6(3)	O1-Eu1-O5 = 74.9(4)	O1-Gd1-O6 = 131.3(2)	O1-Dy1-O5 = 74.9(3)	O1-Eu1-O6 = 130.5(3)	O2-Gd1-N1 = 60.7(2)

N5-Ni3-O22 = 171.9(4)
N5-Ni3-O21 = 89.3(4)
N5-Ni3-N6 = 95.2(5)
N5-Ni3-O29 = 95.6(4)
N5-Ni3-O33 = 89.3(4)
N6-Ni3-O22 = 89.0(4)
N6-Ni3-O21 = 174.2(5)
N6-Ni3-O29 = 93.4(5)
N6-Ni3-O33 = 90.8(5)
O29-Ni3-O33 = 173.2(4)

O5-Dy1-O3 = 69.3(3)
O5-Dy1-O4 = 70.3(3)
O10-Dy1-O5 = 132.2(3)
O10-Dy1-O3 = 130.0(3)
O10-Dy1-O4 = 67.4(3)
O6-Dy1-O5 = 68.6(3)
O6-Dy1-O10 = 78.0(3)
O6-Dy1-O9 = 76.8(3)
O6-Dy1-O3 = 71.0(3)
O6-Dy1-O4 = 72.1(3)
O6-Dy1-O1 = 127.5(3)
O9-Dy1-O5 = 130.9(3)
O9-Dy1-O10 = 68.3(3)
O9-Dy1-O3 = 67.1(3)
O9-Dy1-O4 = 129.9(3)
O4-Dy1-O3 = 132.7(3)
O25-Dy1-O5 = 142.8(3)
O25-Dy1-O10 = 76.8(3)
O25-Dy1-O6 = 148.6(3)
O25-Dy1-O9 = 76.8(3)
O25-Dy1-O3 = 113.0(3)
O25-Dy1-O4 = 113.9(3)
O25-Dy1-O1 = 74.9(4)
O1-Dy1-O5 = 74.7(3)
O1-Dy1-O10 = 151.6(3)
O1-Dy1-O9 = 102.5(3)

O1-Eu1-O6 = 128.4(4)
O1-Eu1-O9 = 107.6(3)
O1-Eu1-O10 = 153.5(4)
O2-Eu1-O3 = 124.1(4)
O2-Eu1-O4 = 62.1(4)
O2-Eu1-O5 = 76.2(3)
O2-Eu1-O6 = 130.2(4)
O2-Eu1-O9 = 152.1(4)
O3-Eu1-O4 = 133.8(4)
O5-Eu1-O3 = 69.1(4)
O5-Eu1-O4 = 69.2(4)
O5-Eu1-O9 = 130.6(3)
O6-Eu1-O3 = 72.7(4)
O6-Eu1-O4 = 73.7(4)
O6-Eu1-O5 = 67.4(3)
O6-Eu1-O9 = 75.1(3)
O9-Eu1-O3 = 69.9(3)
O9-Eu1-O4 = 128.9(4)
O10-Eu1-O2 = 104.0(4)
O10-Eu1-O3 = 131.9(3)
O10-Eu1-O4 = 67.0(4)
O10-Eu1-O5 = 129.2(4)
O10-Eu1-O6 = 76.7(4)
O10-Eu1-O9 = 67.0(3)
O25-Eu1-O1 = 74.4(4)
O25-Eu1-O2 = 76.4(4)
O25-Eu1-O3 = 109.9(4)
O25-Eu1-O4 = 115.5(4)
O25-Eu1-O5 = 144.6(4)
O25-Eu1-O6 = 147.7(3)
O25-Eu1-O9 = 75.9(4)
O25-Eu1-O10 = 79.2(4)
O7-Eu2-O8 = 67.6(4)
O7-Eu2-O13 = 77.9(4)
O7-Eu2-O14 = 130.3(4)
O7-Eu2-O19 = 66.8(4)
O7-Eu2-O20 = 134.3(4)

O1-Gd1-O10 = 109.9(2)
O2-Gd1-O1 = 66.0(2)
O2-Gd1-O3 = 125.5(2)
O2-Gd1-O4 = 61.9(2)
O2-Gd1-O5 = 81.7(2)
O2-Gd1-O6 = 133.0(2)
O2-Gd1-O9 = 99.7(2)
O2-Gd1-O10 = 149.3(2)
O2-Gd1-O25 = 77.4(2)
O3-Gd1-O4 = 137.7(2)
O5-Gd1-O3 = 69.1(2)
O5-Gd1-O4 = 71.7(2)
O6-Gd1-O3 = 75.7(2)
O6-Gd1-O4 = 75.0(2)
O6-Gd1-O5 = 67.1(2)
O6-Gd1-O10 = 74.0(2)
O9-Gd1-O1 = 149.9(2)
O9-Gd1-O3 = 134.2(2)
O9-Gd1-O4 = 66.8(2)
O9-Gd1-O5 = 131.2(2)
O9-Gd1-O6 = 78.2(2)
O9-Gd1-O10 = 68.3(2)
O9-Gd1-O25 = 77.0(2)
O10-Gd1-O3 = 68.7(2)
O10-Gd1-O4 = 129.3(2)
O10-Gd1-O5 = 127.8(2)
O25-Gd1-O1 = 74.0(2)
O25-Gd1-O3 = 104.0(2)
O25-Gd1-O4 = 117.6(2)
O25-Gd1-O5 = 147.7(2)
O25-Gd1-O6 = 143.7(2)
O25-Gd1-O10 = 72.5(2)
O7-Gd2-O14 = 131.2(2)
O7-Gd2-O19 = 128.4(2)
O7-Gd2-O20 = 70.4(2)
O8-Gd2-O7 = 67.6(2)
O8-Gd2-O14 = 130.5(2)

O1-Dy1-O6 = 129.7(3)
O1-Dy1-O9 = 152.1(3)
O1-Dy1-O10 = 106.7(3)
O2-Dy1-O3 = 124.7(3)
O2-Dy1-O4 = 62.5(3)
O2-Dy1-O5 = 75.8(3)
O2-Dy1-O10 = 152.5(3)
O3-Dy1-O4 = 133.8(3)
O5-Dy1-O3 = 69.1(3)
O5-Dy1-O4 = 70.0(3)
O5-Dy1-O10 = 130.3(3)
O6-Dy1-O2 = 130.3(3)
O6-Dy1-O3 = 72.8(3)
O6-Dy1-O4 = 73.1(3)
O6-Dy1-O5 = 68.7(3)
O6-Dy1-O9 = 76.7(3)
O6-Dy1-O10 = 74.6(3)
O9-Dy1-O2 = 103.4(3)
O9-Dy1-O3 = 131.9(3)
O9-Dy1-O4 = 66.6(3)
O9-Dy1-O5 = 130.5(3)
O9-Dy1-O10 = 67.8(3)
O10-Dy1-O3 = 68.8(3)
O10-Dy1-O4 = 128.7(3)
O25-Dy1-O1 = 73.7(3)
O25-Dy1-O2 = 77.4(3)
O25-Dy1-O3 = 109.3(3)
O25-Dy1-O4 = 116.4(3)
O25-Dy1-O5 = 144.4(3)
O25-Dy1-O6 = 146.5(3)
O25-Dy1-O9 = 78.5(3)
O25-Dy1-O10 = 75.3(3)
O7-Dy2-O8 = 68.7(3)
O7-Dy2-O14 = 131.3(3)
O7-Dy2-O19 = 134.0(3)
O7-Dy2-O20 = 66.2(3)
O8-Dy2-O14 = 128.4(3)

O1-Eu1-O9 = 98.9(3)
O1-Eu1-O10 = 148.4(3)
O1-Eu1-O25 = 74.4(3)
O2-Eu1-O1 = 67.9(3)
O2-Eu1-O3 = 125.1(3)
O2-Eu1-O4 = 62.4(3)
O2-Eu1-O5 = 75.9(3)
O2-Eu1-O6 = 129.6(3)
O2-Eu1-O9 = 146.8(3)
O2-Eu1-O10 = 108.1(3)
O2-Eu1-O25 = 73.1(3)
O4-Eu1-O3 = 136.7(2)
O5-Eu1-O3 = 70.2(3)
O5-Eu1-O4 = 71.8(3)
O5-Eu1-O9 = 133.0(3)
O6-Eu1-O3 = 72.3(3)
O6-Eu1-O4 = 74.2(3)
O6-Eu1-O5 = 66.7(2)
O6-Eu1-O9 = 82.6(2)
O9-Eu1-O3 = 66.8(3)
O9-Eu1-O4 = 134.1(3)
O10-Eu1-O3 = 126.6(3)
O10-Eu1-O4 = 69.8(3)
O10-Eu1-O5 = 133.0(3)
O10-Eu1-O6 = 77.4(2)
O10-Eu1-O9 = 66.7(3)
O25-Eu1-O3 = 115.0(3)
O25-Eu1-O4 = 107.9(3)
O25-Eu1-O5 = 144.3(3)
O25-Eu1-O6 = 148.7(3)
O25-Eu1-O9 = 73.9(3)
O25-Eu1-O10 = 74.5(3)
O7-Eu2-O19 = 128.8(3)
O7-Eu2-O20 = 67.9(3)
O8-Eu2-O7 = 68.2(3)
O8-Eu2-O19 = 65.6(3)
O8-Eu2-O20 = 131.9(2)

O2-Gd1-N2 = 118.2(2)
O3-Gd1-O2 = 121.7(2)
O3-Gd1-O6 = 63.4(2)
O3-Gd1-O7 = 158.7(2)
O3-Gd1-O13 = 68.5(2)
O3-Gd1-N1 = 61.0(2)
O3-Gd1-N2 = 120.1(2)
O6-Gd1-N1 = 118.8(2)
O6-Gd1-N2 = 60.3(2)
O7-Gd1-O6 = 120.7(2)
O7-Gd1-N1 = 120.5(2)
O7-Gd1-N2 = 60.4(2)
O9-Gd1-O2 = 70.8(2)
O9-Gd1-O3 = 89.2(2)
O9-Gd1-O6 = 130.9(2)
O9-Gd1-O7 = 72.7(2)
O9-Gd1-O10 = 63.7(3)
O9-Gd1-O13 = 139.3(2)
O9-Gd1-O14 = 134.6(2)
O9-Gd1-N1 = 71.3(2)
O9-Gd1-N2 = 112.9(2)
O10-Gd1-O2 = 131.8(2)
O10-Gd1-O3 = 73.7(2)
O10-Gd1-O6 = 69.6(2)
O10-Gd1-O7 = 87.9(2)
O10-Gd1-O13 = 133.3(2)
O10-Gd1-O14 = 136.6(2)
O10-Gd1-N1 = 115.1(3)
O10-Gd1-N2 = 69.2(2)
O13-Gd1-O6 = 69.5(2)
O13-Gd1-O7 = 132.8(2)
O13-Gd1-N1 = 68.2(2)
O13-Gd1-N2 = 107.7(2)
O14-Gd1-O2 = 70.6(2)
O14-Gd1-O3 = 131.8(2)
O14-Gd1-O6 = 90.4(2)
O14-Gd1-O7 = 69.3(2)

O1-Dy1-O3 = 61.6(3)
O1-Dy1-O4 = 127.6(3)
O2-Dy1-O5 = 76.4(3)
O2-Dy1-O10 = 101.3(3)
O2-Dy1-O6 = 128.8(3)
O2-Dy1-O9 = 151.3(3)
O2-Dy1-O3 = 128.7(3)
O2-Dy1-O4 = 61.3(3)
O2-Dy1-O25 = 74.7(4)
O2-Dy1-O1 = 73.5(3)
O7-Dy2-O19 = 66.1(2)
O7-Dy2-O8 = 69.3(3)
O7-Dy2-O13 = 78.9(3)
O7-Dy2-O14 = 130.5(3)
O7-Dy2-O20 = 132.0(3)
O8-Dy2-O19 = 129.8(3)
O8-Dy2-O14 = 133.5(3)
O8-Dy2-O20 = 67.2(3)
O13-Dy2-O19 = 71.6(3)
O13-Dy2-O8 = 78.5(3)
O13-Dy2-O14 = 68.3(3)
O13-Dy2-O20 = 73.6(3)
O18-Dy2-O7 = 150.2(3)
O18-Dy2-O19 = 126.4(3)
O18-Dy2-O8 = 103.8(3)
O18-Dy2-O13 = 129.3(3)
O18-Dy2-O14 = 76.0(3)
O18-Dy2-O20 = 62.0(3)
O17-Dy2-O7 = 99.0(3)
O17-Dy2-O19 = 61.9(3)
O17-Dy2-O8 = 148.7(3)
O17-Dy2-O13 = 129.2(3)
O17-Dy2-O18 = 71.6(3)
O17-Dy2-O28 = 74.2(3)
O17-Dy2-O14 = 76.5(3)
O17-Dy2-O20 = 128.9(3)
O28-Dy2-O7 = 74.9(3)
O8-Eu2-O14 = 127.0(4)
O8-Eu2-O19 = 128.5(4)
O8-Eu2-O20 = 69.0(3)
O13-Eu2-O8 = 72.9(4)
O13-Eu2-O14 = 66.4(4)
O13-Eu2-O19 = 75.2(4)
O13-Eu2-O20 = 76.4(4)
O14-Eu2-O19 = 71.3(3)
O14-Eu2-O20 = 69.7(4)
O17-Eu2-O7 = 99.3(4)
O17-Eu2-O8 = 149.9(4)
O17-Eu2-O13 = 132.9(4)
O17-Eu2-O14 = 82.5(4)
O17-Eu2-O18 = 66.1(3)
O17-Eu2-O19 = 61.3(4)
O17-Eu2-O20 = 125.7(4)
O18-Eu2-O7 = 150.7(4)
O18-Eu2-O8 = 111.7(4)
O18-Eu2-O13 = 131.0(4)
O18-Eu2-O14 = 75.0(4)
O18-Eu2-O19 = 119.8(4)
O18-Eu2-O20 = 62.2(3)
O20-Eu2-O19 = 138.4(4)
O27-Eu2-O7 = 78.2(4)
O27-Eu2-O8 = 73.2(4)
O27-Eu2-O13 = 143.9(4)
O27-Eu2-O14 = 148.0(4)
O27-Eu2-O17 = 77.6(4)
O27-Eu2-O18 = 74.0(4)
O27-Eu2-O19 = 118.5(4)
O27-Eu2-O20 = 102.4(4)
O11-Eu3-O12 = 66.8(3)
O11-Eu3-O15 = 76.1(4)
O11-Eu3-O16 = 79.4(4)
O11-Eu3-O21 = 130.5(4)
O11-Eu3-O22 = 129.0(4)
O11-Eu3-O23 = 74.8(4)
O8-Gd2-O19 = 67.2(2)
O8-Gd2-O20 = 134.6(2)
O13-Gd2-O7 = 75.8(2)
O13-Gd2-O8 = 79.0(2)
O13-Gd2-O14 = 67.2(2)
O13-Gd2-O19 = 72.5(2)
O13-Gd2-O20 = 74.8(2)
O14-Gd2-O19 = 68.7(2)
O14-Gd2-O20 = 70.0(2)
O17-Gd2-O7 = 151.0(2)
O17-Gd2-O8 = 100.7(2)
O17-Gd2-O13 = 129.7(2)
O17-Gd2-O14 = 77.0(2)
O17-Gd2-O18 = 66.8(2)
O17-Gd2-O19 = 62.0(2)
O17-Gd2-O20 = 124.6(2)
O18-Gd2-O7 = 109.5(2)
O18-Gd2-O8 = 149.9(2)
O18-Gd2-O13 = 130.5(2)
O18-Gd2-O14 = 75.2(2)
O18-Gd2-O19 = 122.1(2)
O18-Gd2-O20 = 62.5(2)
O20-Gd2-O19 = 134.6(2)
O28-Gd2-O7 = 75.5(2)
O28-Gd2-O8 = 75.4(2)
O28-Gd2-O13 = 147.0(2)
O28-Gd2-O14 = 145.7(2)
O28-Gd2-O17 = 75.9(2)
O28-Gd2-O18 = 75.0(3)
O28-Gd2-O19 = 114.9(3)
O28-Gd2-O20 = 109.8(2)
O11-Gd3-O12 = 67.7(2)
O11-Gd3-O16 = 74.9(2)
O11-Gd3-O21 = 129.8(2)
O11-Gd3-O23 = 73.3(2)
O11-Gd3-O24 = 72.9(2)
O12-Gd3-O16 = 130.5(2)
O8-Dy2-O19 = 68.1(3)
O8-Dy2-O20 = 128.7(3)
O13-Dy2-O7 = 78.4(3)
O13-Dy2-O8 = 74.2(3)
O13-Dy2-O14 = 67.6(3)
O13-Dy2-O17 = 131.4(3)
O13-Dy2-O19 = 75.5(3)
O13-Dy2-O20 = 74.1(3)
O14-Dy2-O19 = 69.8(3)
O14-Dy2-O20 = 71.5(3)
O17-Dy2-O7 = 149.7(3)
O17-Dy2-O8 = 109.8(3)
O17-Dy2-O14 = 74.7(3)
O17-Dy2-O19 = 63.1(3)
O17-Dy2-O20 = 121.4(3)
O18-Dy2-O7 = 98.9(3)
O18-Dy2-O8 = 149.1(3)
O18-Dy2-O13 = 132.8(3)
O18-Dy2-O14 = 81.3(3)
O18-Dy2-O17 = 66.3(3)
O18-Dy2-O19 = 126.5(3)
O18-Dy2-O20 = 62.4(3)
O18-Dy2-O28 = 77.6(3)
O19-Dy2-O20 = 137.5(3)
O28-Dy2-O7 = 76.9(3)
O28-Dy2-O8 = 72.2(3)
O28-Dy2-O13 = 143.6(3)
O28-Dy2-O14 = 147.3(3)
O28-Dy2-O17 = 74.1(3)
O28-Dy2-O19 = 103.8(3)
O28-Dy2-O20 = 118.3(3)
O11-Dy3-O15 = 131.3(3)
O11-Dy3-O23 = 69.6(3)
O11-Dy3-O24 = 69.2(3)
O12-Dy3-O11 = 67.8(3)
O12-Dy3-O15 = 75.6(3)
O12-Dy3-O16 = 79.1(3)
O13-Eu2-O7 = 75.8(3)
O13-Eu2-O8 = 76.9(3)
O13-Eu2-O14 = 67.5(3)
O13-Eu2-O17 = 131.4(3)
O13-Eu2-O18 = 128.7(3)
O13-Eu2-O19 = 73.6(3)
O13-Eu2-O20 = 74.2(3)
O13-Eu2-O28 = 147.1(3)
O14-Eu2-O7 = 131.5(3)
O14-Eu2-O8 = 128.4(3)
O14-Eu2-O19 = 69.1(3)
O14-Eu2-O20 = 72.3(3)
O14-Eu2-O28 = 145.5(3)
O17-Eu2-O7 = 149.4(3)
O17-Eu2-O8 = 101.0(3)
O17-Eu2-O14 = 78.1(3)
O17-Eu2-O18 = 70.1(3)
O17-Eu2-O19 = 62.3(3)
O17-Eu2-O20 = 126.9(2)
O17-Eu2-O28 = 73.7(3)
O18-Eu2-O7 = 105.8(3)
O18-Eu2-O8 = 152.7(3)
O18-Eu2-O14 = 76.3(3)
O18-Eu2-O19 = 125.3(2)
O18-Eu2-O20 = 60.7(2)
O18-Eu2-O28 = 75.6(3)
O19-Eu2-O20 = 136.8(3)
O28-Eu2-O7 = 76.0(3)
O28-Eu2-O8 = 77.1(3)
O28-Eu2-O19 = 112.9(3)
O28-Eu2-O20 = 109.9(3)
O11-Eu3-O15 = 77.2(3)
O11-Eu3-O23 = 73.4(2)
O11-Eu3-O24 = 76.8(3)
O11-Eu3-O30 = 145.2(3)
O12-Eu3-O11 = 67.0(3)
O12-Eu3-O15 = 132.5(3)
O14-Gd1-O13 = 64.4(2)
O14-Gd1-N1 = 108.3(2)
O14-Gd1-N2 = 67.4(2)
N1-Gd1-N2 = 175.4(2)

O28-Dy2-O19 = 113.3(3)
O28-Dy2-O8 = 74.7(3)
O28-Dy2-O13 = 147.7(3)
O28-Dy2-O18 = 75.3(3)
O28-Dy2-O14 = 144.0(3)
O28-Dy2-O20 = 111.1(3)
O14-Dy2-O19 = 68.9(3)
O14-Dy2-O20 = 72.8(3)
O20-Dy2-O19 = 135.4(2)
O30-Dy3-O24 = 115.2(3)
O30-Dy3-O12 = 140.9(3)
O30-Dy3-O15 = 76.3(3)
O30-Dy3-O16 = 76.4(3)
O30-Dy3-O23 = 111.1(3)
O30-Dy3-O11 = 151.5(3)
O12-Dy3-O24 = 69.3(3)
O12-Dy3-O23 = 71.5(3)
O22-Dy3-O30 = 74.6(3)
O22-Dy3-O24 = 61.6(3)
O22-Dy3-O12 = 75.1(3)
O22-Dy3-O15 = 150.3(3)
O22-Dy3-O16 = 99.2(3)
O22-Dy3-O21 = 73.5(3)
O22-Dy3-O23 = 129.1(3)
O22-Dy3-O11 = 127.0(3)
O15-Dy3-O24 = 128.5(2)
O15-Dy3-O12 = 133.7(3)
O15-Dy3-O23 = 68.0(3)
O16-Dy3-O24 = 67.1(3)
O16-Dy3-O12 = 132.7(3)
O16-Dy3-O15 = 67.9(3)
O16-Dy3-O23 = 131.6(3)
O21-Dy3-O30 = 73.4(3)
O21-Dy3-O24 = 127.8(3)
O21-Dy3-O12 = 74.8(3)
O21-Dy3-O15 = 103.7(3)
O21-Dy3-O16 = 149.8(3)
O11-Eu3-O24 = 72.8(4)
O12-Eu3-O15 = 130.9(4)
O12-Eu3-O23 = 70.2(4)
O12-Eu3-O24 = 69.4(4)
O15-Eu3-O23 = 70.0(4)
O15-Eu3-O24 = 128.4(4)
O16-Eu3-O12 = 130.6(4)
O16-Eu3-O15 = 67.8(4)
O16-Eu3-O21 = 149.7(4)
O16-Eu3-O22 = 100.6(4)
O16-Eu3-O23 = 134.5(4)
O16-Eu3-O24 = 66.7(4)
O21-Eu3-O12 = 75.1(4)
O21-Eu3-O15 = 110.0(4)
O21-Eu3-O22 = 66.4(4)
O21-Eu3-O23 = 63.0(4)
O21-Eu3-O24 = 121.6(4)
O22-Eu3-O12 = 76.8(4)
O22-Eu3-O15 = 151.5(4)
O22-Eu3-O23 = 124.7(4)
O22-Eu3-O24 = 61.4(4)
O23-Eu3-O24 = 135.5(4)
O29-Eu3-O11 = 147.4(4)
O29-Eu3-O12 = 145.7(4)
O29-Eu3-O15 = 75.3(4)
O29-Eu3-O16 = 75.7(4)
O29-Eu3-O21 = 74.6(4)
O29-Eu3-O22 = 76.6(4)
O29-Eu3-O23 = 108.9(4)
O29-Eu3-O24 = 114.8(4)
O12-Gd3-O23 = 69.1(2)
O12-Gd3-O24 = 69.8(2)
O15-Gd3-O11 = 76.8(2)
O15-Gd3-O12 = 129.4(2)
O15-Gd3-O16 = 67.6(2)
O15-Gd3-O21 = 103.7(2)
O15-Gd3-O23 = 66.9(2)
O15-Gd3-O24 = 131.9(2)
O16-Gd3-O23 = 128.9(2)
O16-Gd3-O24 = 68.9(2)
O21-Gd3-O12 = 75.6(2)
O21-Gd3-O16 = 152.7(2)
O21-Gd3-O23 = 62.0(2)
O21-Gd3-O24 = 124.5(2)
O22-Gd3-O11 = 129.0(2)
O22-Gd3-O12 = 75.2(2)
O22-Gd3-O15 = 152.8(2)
O22-Gd3-O16 = 107.3(2)
O22-Gd3-O21 = 68.1(2)
O22-Gd3-O23 = 123.8(2)
O22-Gd3-O24 = 62.0(2)
O24-Gd3-O23 = 134.0(2)
O30-Gd3-O11 = 147.4(2)
O30-Gd3-O12 = 144.5(2)
O30-Gd3-O15 = 79.3(2)
O30-Gd3-O16 = 75.6(2)
O30-Gd3-O21 = 77.4(2)
O30-Gd3-O22 = 73.6(2)
O30-Gd3-O23 = 116.5(2)
O30-Gd3-O24 = 108.8(2)
O12-Dy3-O21 = 130.7(3)
O12-Dy3-O22 = 129.1(3)
O12-Dy3-O23 = 74.5(3)
O12-Dy3-O24 = 71.9(3)
O15-Dy3-O23 = 70.4(3)
O15-Dy3-O24 = 127.8(3)
O16-Dy3-O11 = 131.1(3)
O16-Dy3-O15 = 67.8(3)
O16-Dy3-O22 = 99.5(3)
O16-Dy3-O23 = 134.7(3)
O16-Dy3-O24 = 66.8(3)
O21-Dy3-O11 = 74.9(3)
O21-Dy3-O15 = 109.3(3)
O21-Dy3-O16 = 149.5(3)
O21-Dy3-O22 = 68.0(3)
O21-Dy3-O23 = 62.7(3)
O21-Dy3-O24 = 122.8(3)
O22-Dy3-O11 = 76.9(3)
O22-Dy3-O15 = 151.2(3)
O22-Dy3-O23 = 125.7(3)
O22-Dy3-O24 = 61.6(3)
O23-Dy3-O24 = 134.0(3)
O30-Dy3-O11 = 146.1(3)
O30-Dy3-O12 = 146.0(3)
O30-Dy3-O15 = 74.5(3)
O30-Dy3-O16 = 74.9(3)
O30-Dy3-O21 = 75.2(3)
O30-Dy3-O22 = 77.2(3)
O30-Dy3-O23 = 109.7(3)
O30-Dy3-O24 = 115.8(3)
O12-Eu3-O16 = 128.3(3)
O12-Eu3-O22 = 77.9(3)
O12-Eu3-O23 = 69.7(2)
O12-Eu3-O24 = 74.5(3)
O12-Eu3-O30 = 147.8(3)
O15-Eu3-O23 = 128.7(3)
O15-Eu3-O24 = 67.4(3)
O16-Eu3-O11 = 77.4(3)
O16-Eu3-O15 = 68.3(3)
O16-Eu3-O22 = 150.0(3)
O16-Eu3-O23 = 64.9(3)
O16-Eu3-O24 = 132.4(3)
O16-Eu3-O30 = 74.4(3)
O21-Eu3-O11 = 131.6(2)
O21-Eu3-O12 = 79.1(3)
O21-Eu3-O15 = 147.4(3)
O21-Eu3-O16 = 100.0(3)
O21-Eu3-O22 = 67.6(3)
O21-Eu3-O23 = 62.7(2)
O21-Eu3-O24 = 126.8(3)
O21-Eu3-O30 = 73.8(3)
O22-Eu3-O11 = 131.8(3)
O22-Eu3-O15 = 106.8(3)
O22-Eu3-O23 = 124.2(3)
O22-Eu3-O24 = 62.3(3)
O22-Eu3-O30 = 75.8(3)
O24-Eu3-O23 = 140.0(2)
O30-Eu3-C24 = 72.0(3)
O30-Eu3-O15 = 73.7(3)
O30-Eu3-O23 = 111.3(2)

O21-Dy3-O23 = 61.5(3)
O21-Dy3-O11 = 126.8(3)
O23-Dy3-O24 = 133.3(3)
O11-Dy3-O24 = 70.7(3)
O11-Dy3-O12 = 67.5(3)
O11-Dy3-O15 = 79.0(3)
O11-Dy3-O16 = 81.3(3)
O11-Dy3-O23 = 71.6(3)

Reference

1. E. D. Fenton and J. R. Tate, *Inorg. Chim. Acta*, 1984, **83**, 23.