Suplementarny materials

Gorerite, $CaAlFe_{11}O_{19}$, a new mineral of the magnetoplumbite group from the Negev Desert, Israel

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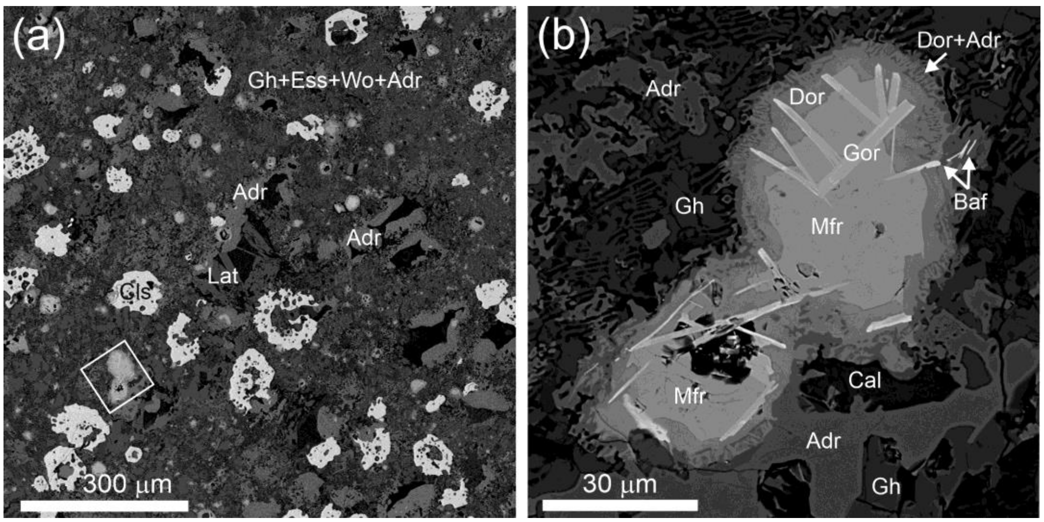

Figure S1. (a) Zone II (central part) with celsian metacrysts, rare ferrite aggregates and cavities, on walls of which relatively large andradite crystals grow. Cavities are filled by calcite and/or tacharanite and/or zeolites; sometimes, latiumite is observed in these cavities. Fragment magnified in Fig. 5B is outlined by frame; (b) Magnesioferrite grain with gorerite inclusions and rim composed by dorrite and andradite. BSE images. Adr = andradite, Baf = baroferrite, Cal = calcite, Cls = celsian, Dor = dorrite, Ess = esseneite, Gh = gehlenite-ackermanite series, Gor = gorerite, Lat = latiumite, Mfr = magnesioferrite, Wo = wollastonite.

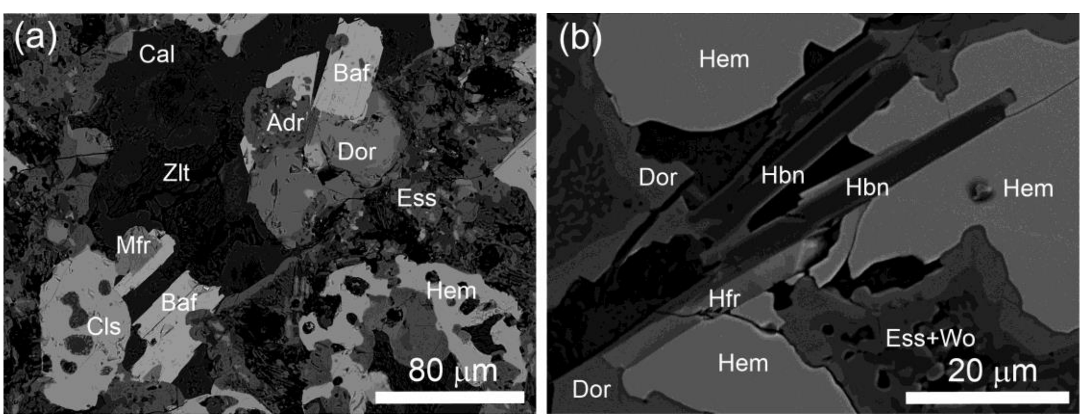

Figure S2. (a) Barioferrite crystals; (b) – epitaxial overgrowths of „Sr-Ba-gorerite" on hibonite from porous fragments of rock at the periphery of the hematite zone I. BSE images. Adr = andradite, Baf = barioferrite, Cal = calcite, Cls = celsian, Dor = dorrite, Ess = esseneite, Hem = hematite, Hbn = hibonite, Hfr = hexaferrie „Sr-Ba-gorerite", Mfr = magnesioferrite, Wo = wollastonite, Zlt = zeolite.

Table S1. Hexagonal ferrites: hibonite relicts in gorerite (1), hibonite (2) from intergrowth with Sr-Ba-bearing hexaferrite (3), single crystals of barioferrite (4,5)

	1			2			3			4			5
	Fig. 4c,5c			Fig. S2b			Fig. S2b			Fig. S2a			Fig. S2a
wt.%	*n*=11	s.d.	range	*n*=21	s.d.	range	*n*=7	s.d.	range	*n*=8 core	s.d.	range	*n*=2 rim
TiO_2	5.63	0.36	5.04-6.21	5.69	0.46	4.72-6.46	3.45	0.21	3.14-3.74	0.19	0.09	0.04-0.29	1.52
SiO_2	0.10	0.15	0-0.55	0.07	0.05	0-0.19	0.08	0.03	0.04-0.12	0.25	0.04	0.19-0.29	0.17
Fe_2O_3	25.22	2.03	22.60-28.80	26.22	1.60	24.08-29.53	57.93	1.81	53.76-59.50	83.85	0.38	83.28-84.40	80.24
Cr_2O_3	0.18	0.04	0.14-0.27	0.14	0.02	0.10-0.18	0.37	0.05	0.28-0.44	n.d.			n.d.
V_2O_3				0.11	0.05	0-0.17	0.13	0.04	0.07-0.17	n.d.			n.d.
Al_2O_3	58.25	1.47	55.65-60.47	56.66	1.16	54.09-58.54	26.27	1.58	24.62-29.92	2.49	0.10	2.40-2.71	4.99
BaO	n.d.			n.d.			2.26	0.40	1.51-2.89	11.72	0.55	10.79-12.42	10.20
SrO	0.07	0.08	0-0.25	n.d.			3.72	0.18	3.40-3.98	0.40	0.14	0.23-0.69	1.11
FeO*	0.35			0.37						n.d.			n.d.
MnO	n.d.			0.10	0.03	0.04-0.16	0.12	0.02	0.07-0.15	n.d.			0.12
CaO	7.65	0.14	7.41-7.91	7.66	0.21	7.40-8.49	3.31	0.19	2.99-3.57	1.05	0.27	0.62-1.40	1.01
MgO	2.56	0.17	2.35-2.91	2.41	0.14	2.10-2.67	1.28	0.08	1.19-1.43	0.18	0.03	0.12-0.22	0.74
K_2O	n.d.			n.d.			0.24	0.03	0.20-0.27	0.00	0.02	0-0.07	0.05
Na_2O	n.d.			0.03	0.02	0-0.08	0.03	0.02	0-0.06	n.d.			n.d.
Total	100.03			99.47			99.16			100.14			100.15
Calculated on 19O													
Ca	0.99			0.99			0.48			0.15			0.18
Ba							0.13			0.82			0.70
Sr	0.01						0.32			0.04			0.11
K							0.05						0.01
Na				0.01			0.01						
A	1.00			1.00			1.00			1.01			1.00
Al	8.54			8.40			4.65			0.53			1.03
Fe^{3+}	2.36			2.48			6.54			11.30			10.52
Mg	0.48			0.45			0.29			0.05			0.19
Ti^{4+}	0.53			0.54			0.39			0.03			0.20
Mn^{2+}				0.01			0.02						
Ca	0.03			0.04			0.05			0.05			0.01
Cr^{3+}	0.02			0.01			0.04						
V^{3+}				0.01			0.02						
Si	0.01			0.01			0.01			0.05			0.03
Fe^{2+}	0.04			0.04									0.02
B	12.00			12.00			12.00			12.00			12.00

n.d. – not detected, * - Fe^{2+}/Fe^{3+} ratio calculated on charge balance

Table S2. Oxyspinel group minerals: magnesioferrite (1,2) and maghemite (3,4)

	1	2			3			4		
	Fig. 5a	Fig. 4c			Fig. 4c			Fig. 5a		
wt.%	*n*=4	*n*=12	s.d.	range	*n*=6	s.d.	range	*n*=6	s.d.	range
TiO_2	0.00	0.00	0.02	0-0.06	0.31	0.02	0.28-0.35	0.12	0.02	0.09-0.16
Fe_2O_3	68.32	63.35	1.01	61.75-65.45	92.20	0.56	91.22-92.68	93.21	0.38	92.92-93.98
Cr_2O_3	0.46	0.48	0.08	0.42-0.74	0.33	0.01	0.32-0.35	0.24	0.02	0.22-0.29
Al_2O_3	5.37	12.51	0.97	10.09-14.34	6.07	0.08	5.99-6.22	5.24	0.18	5.03-5.58
ZnO	0.12	0.23	0.05	0.16-0.33	n.d.			n.d.		
NiO	0.24	0.38	0.08	0.27-0.60	n.d.			n.d.		
FeO*	9.67	2.70								
MnO	0.76	1.02	0.10	0.87-1.16	n.d.			n.d.		
CaO	0.23	0.37	0.07	0.31-0.56	0.31	0.05	0.27-0.41	0.13	0.03	0.07-0.18
MgO	13.27	18.38	0.29	18.03-18.96	0.11	0.01	0.09-0.13	0.05	0.02	0.02-0.07
Total	98.45	99.43			99.34			98.99		
Calculated on 4O										
Mg	0.68	0.87			0.01					
Fe^{2+}	0.28	0.07								
Mn^{2+}	0.02	0.03								
Ni^{2+}	0.01	0.01								
Zn		0.01								
Ca	0.01	0.01			0.01					
Fe^{3+}					0.66			0.66		
A	1.00	1.00			0.68			0.66		
Fe^{3+}	1.77	1.52			1.73			1.78		
Al	0.22	0.47			0.25			0.21		
Ti^{4+}					0.01					
Cr^{3+}	0.01	0.01			0.01			0.01		
B	2.00	2.00			2.00			2.00		

n.d. – not detected, * - Fe^{2+}/Fe^{3+} ratio calculated on charge balance

Table S3. Chemical composition of hematite

	1			2		
	Fig. 4a,b			Fig. S2b		
	n=11	s.d.	range	*n*=24	s.d.	range
TiO_2	0.08	0.05	0-0.16	0.71	0.25	0.10-0.43
Fe_2O_3	96.86	0.40	95.85-97.45	94.36	0.57	93.48-95.30
Cr_2O_3	0.29	0.07	0.25-0.45	0.23	0.03	0.18-0.19
Al_2O_3	1.77	0.15	1.55-1.96	2.80	0.27	2.37-2.87
MgO	0.09	0.18	0-0.65	0.23	0.08	0.08-0.15
CaO	0.21	0.10	0.08-0.40	0.17	0.09	0.02-0.13
Total	99.30			98.49		
Calculated on 3O						
Fe^{3+}	1.93			1.88		
Al	0.06			0.09		
Cr^{3+}	0.01					
Mg	0.00			0.01		
Ca	0.01					
Ti^{4+}				0.01		

Table S4. Reflectance data for gorerite

R_{max}	R_{min}	λ (nm)
23.5(0.5)	21.4(0.5)	470 (COM)
23.3(0.5)	21.2(0.5)	486
22.6(0.5)	20.3(0.5)	546 (COM)
21.7(0.5)	19.8(0.5)	589 (COM)
20.2(0.5)	18.5(0.5)	650 (COM)
20.0(0.5)	18.4(0.5)	656

Reference material: WTiC no.370 (Zeiss) and "Gadolinium-Gallium-Garnet" (Craic Technologies).

Table S5. Calculated powder diffraction data for gorerite (Cu$K\alpha$ = 1.540598 Å, Debye-Scherrer geometry, I > 2; data were calculated using PowderCell 2.4 (Krause and Nolze, 1996)

h	*k*	*l*	d_{hkl}	$I_{rel.}$[%]	*h*	*k*	*l*	d_{hkl}	$I_{rel.}$[%]
0	0	4	5.6778	12	1	0	12	1.7627	3
1	0	0	4.8420	3	2	0	9	1.7470	3
1	0	1	4.7355	3	2	0	10	1.6564	10
1	0	3	4.0790	20	2	1	6	1.6476	4
0	0	6	3.7852	6	0	0	14	1.6222	7
1	0	5	3.3127	6	3	0	0	1.6140	5
1	0	6	2.9821	14	**2**	**1**	**7**	**1.5940**	**31**
0	0	8	2.8389	13	**2**	**0**	**11**	**1.5710**	**46**
1	**1**	**0**	**2.7955**	**40**	3	0	4	1.5525	14
1	1	2	2.7145	2	2	1	8	1.5382	12
1	**0**	**7**	**2.6953**	**100**	2	0	12	1.4910	8
1	**1**	**4**	**2.5080**	**94**	3	0	6	1.4847	4
1	**0**	**8**	**2.4490**	**22**	2	0	13	1.4167	7
2	0	0	2.4210	10	**2**	**2**	**0**	**1.3978**	**42**
2	**0**	**1**	**2.4073**	**26**	2	0	14	1.3477	9
2	0	2	2.3678	10	2	1	12	1.3156	2
2	**0**	**3**	**2.3059**	**39**	1	0	17	1.2878	2
1	1	6	2.2487	16	2	2	8	1.2540	3
2	**0**	**5**	**2.1365**	**27**	3	1	7	1.2408	9
2	0	6	2.0395	17	3	1	8	1.2139	3
2	0	7	1.9403	5	4	0	1	1.2088	2
1	0	11	1.8992	2					

Krause W. and Nolze G. (1996) POWDER CELL - a program for the representation and manipulation of crystal structures and calculation of the resulting X-ray powder patterns. Journal of Applied Crystallography, 29, 301–303.