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CHEMICAL AND CRYSTALLOGRAPHIC DATA FOR VONSENITE FROM BURGUILLOS DEL CERRO, BADAJOZ, SPAIN

J. Lopez Ruiz and P. Salvador Salvador, *Instituto "Lucas Mallada," C.S.I.C., Facultad de Ciencias (3er Pabellón), Madrid 3 (Spain).*

Abstract

A chemical analysis and X-ray crystallographic data are given for vonsenite from Burguillos del Cerro, Badajoz, Spain.

The samples used in this study come from the Monchi mine, Burguillos del Cerro (Badajoz). They were supplied by the Laboratory of Petrology of the Instituto Geológico y Minero de España.

The iron and uranium deposits of the Burguillos del Cerro area are typical skarn deposits. They occur at the contact between Cambrian limestones and Hercynian plutonic rocks (diorites, monzonites, syenites, and granodiorites). The skarn comprises both lime-rich and pyroxenic hornfelses. Some feldspathic hornfels is also present. Radioactive minerals and iron minerals (uraninite, allanite, magnetite, pyrrhotite, chalcopyrite, cobaltite, löllingite, and pyrite) are found in the lime-rich and pyroxenic hornfelses (Arribas, 1962; Arribas *et al.*, 1967).

TABLE 1. CHEMICAL ANALYSES OF VONSENITE FROM BURGUILLOS DEL CERRO, BADAJOZ, SPAIN

	1	2	3
Fe_2O_3	30.90	-	29.51
Al_2O_3	-	0.22	-
FeO	55.62	83.32[a]	54.14
MnO	-	0.20	-
MgO	-	0.28	-
CoO	-	0.05	-
B_2O_3	13.48	-	12.40

1 - $Fe_2^{2+}\ Fe^{3+}\ BO_5$

2 - Microprobe determinations.[a] Total iron as FeO.

3 - Chemical determinations.

TABLE 2. X-RAY DIFFRACTION DATA FOR VONSENITE FROM BURGUILLOS DEL CERRO, BADAJOZ, SPAIN

Orthorhombic, P_{bam}, a, 9,452(1) b, 12,287(1) c, 3,072(1) Å

h k l	d_{cal}	d_{obs}	I_r	h k l	d_{cal}	d_{obs}	I_r
1 1 0	7.492	7.470	2	3 7 0	1.533	--	--
0 2 0	6.144	6.140	1	6 2 0	1.526	1.526	< 1
1 2 0	5.151	5.152	30	1 8 0	1.516	--	--
2 0 0	4.726	4.725	8	1 7 1	1.505	1.505	5
2 1 0	4.411	--	--	1 1 2	1.505		
1 3 0	3.758	3.760	4	3 6 1	1.499		
2 2 0	3.746	--	--	5 5 0	1.498	1.498	5
2 3 0	3.095	--	--	5 3 1	1.498		
0 4 0	3.072	3.070	3	0 2 2	1.490	1.490	< 1
0 0 1	3.072			4 5 1	1.490		
3 1 0	3.052	3.050	3	6 3 0	1.470	--	--
1 4 0	2.921	2.923	3	1 2 2	1.472	1.472	< 1
1 1 1	2.843	2.842	9	2 8 0	1.461	--	--
3 2 0	2.804	2.804	7	2 0 2	1.461	--	--
0 2 1	2.748	2.747	3	2 1 2	1.451	--	--
1 2 1	2.639	--	--	2 7 1	1.451	--	--
2 4 0	2.576	2.575	100	5 4 1	1.426	--	--
2 0 1	2.576			2 2 2	1.421	1.421	< 1
2 1 1	2.521	2.521	< 1	1 3 2	1.422	--	--
3 3 0	2.497	2.496	3	4 7 0	1.409	1.409	< 1
1 5 0	2.378	2.377	7	6 4 0	1.402	1.402	15
1 3 1	2.379			6 0 1	1.402		
2 2 1	2.376			6 1 1	1.393	--	--
4 0 0	2.363	2.363	7	5 6 0	1.389	--	--
4 1 0	2.321	--	--	3 8 0	1.381	--	--
4 2 0	2.206	--	--	4 6 1	1.382	--	--
3 4 0	2.199	--	--	2 3 2	1.376	--	--
2 5 0	2.180	2.180	5	0 8 1	1.374	1.374	< 1
2 3 1	2.181			0 4 2	1.374		
0 4 1	2.172	2.175	3	3 7 1	1.372	1.372	< 1
3 1 1	2.165	2.165	3	3 1 2	1.372		
1 4 1	2.117	--	--	6 2 1	1.367	--	--
3 2 1	2.071	2.070	7	1 8 1	1.360	--	--
4 3 0	2.047	--	--	1 4 2	1.360	--	--
0 6 0	2.048	--	--	1 9 0	1.351	1.351	< 1
1 6 0	2.001	2.002	5	5 5 1	1.347	1.347	1
2 4 1	1.974	--	--	3 2 2	1.347		
3 5 0	1.938	1.937	12	7 1 0	1.342	1.342	< 1
3 3 1	1.938			6 5 0	1.326	1.326	< 1
2 6 0	1.879	1.879	3	6 3 1	1.326		
1 5 1	1.881			2 8 1	1.319		
4 4 0	1.873	1.872	8	2 4 2	1.319	1.319	8
4 0 1	1.873			7 2 0	1.319		
5 1 0	1.868	1.868	3	2 9 0	1.312	1.312	< 1
4 1 1	1.852	1.852	< 1	3 3 2	1.308	--	--
5 2 0	1.807	1.806	4	1 5 2	1.290	1.290	< 1
4 2 1	1.792	1.791	3	5 7 0	1.286	1.286	1
3 4 1	1.788	--	--	4 8 0	1.288	1.288	7
2 5 1	1.778	1.778	< 1	4 0 2	1.288		
1 7 0	1.726	1.726	1	7 3 0	1.282	1.282	1
5 3 0	1.716	--	--	4 7 1	1.281	--	--
3 6 0	1.717	1.717	1	4 1 2	1.281	--	--
4 5 0	1.703	--	--	6 4 1	1.275	--	--
4 3 1	1.703	--	--	5 6 1	1.266	--	--
0 6 1	1.704	--	--	3 8 1	1.259	1.259	< 1
1 6 1	1.677	1.677	1.	3 4 2	1.259		
2 7 0	1.645	--	--	4 2 2	1.261	1.261	< 1
3 5 1	1.639	--	--	2 5 2	1.256	1.256	< 1
5 4 0	1.610	1.610	1	3 9 0	1.253	1.253	< 1
2 6 1	1.603	1.603	3	6 6 0	1.249	1.249	< 1
4 4 1	1.599	1.599	8	1 9 1	1.237	1.237	< 1
5 1 1	1.596	--	--	7 4 0	1.236	--	--
6 0 0	1.575	1.575	1	0 10 0	1.229	--	--
6 1 0	1.563	--	--	4 3 2	1.229	--	--
5 2 1	1.557	1.557	3	0 6 2	1.229	--	--
4 6 0	1.548	1.548	<1	7 1 1	1.230	--	--
0 8 0	1.536	1.536	17	1 10 0	1.218	1.218	1
0 0 2	1.536			6 5 1	1.218		

Data obtained from an X-ray powder diffractogram made with a Philips Diffractometer PW/1051, using: flat rotatory sample-holder; CuKα radiation, Ni filter; proportional counter with pulse-height analyzer; 1°/0, 1°/1°, divergence, receiving and scatter slits. Goniometer speed: 1/8°/min; chart speed: 40 cm/h.

Relative intensities represent addition of Kα_1 and Kα_2 peak areas.

NaCl reflection 200 as internal standard.

Vonsenite occurs within the iron ore, together with magnetite and hedenbergite.

Chemical analyses of vonsenite are given in Table 1. Weissenberg photographs taken in our laboratory show that the mineral is orthorhombic, space group *Pbam*, in agreement with the earlier determination by Takeuchi (1956). The interplanar spacings and relative intensities of all reflections with $2\theta < 80°$, obtained from an X-ray powder diffractogram, as well as the unitcell constants refined by least squares, are given in Table 2.

The data in Table 1, recalculated so that $Fe^{3+} + Al = 1$, lead to the formula $(Fe^{2+}_{2.03}\ Mg_{0.02}\ Mn_{0.007}\ Co_{0.002})\ (Fe^{3+}_{0.99}\ Al_{0.01})\ B_{0.96}\ O_5$. That is, the composition of Burguillos vonsenite is close to that of the $Fe^{2+}_2\ Fe^{3+}\ BO_5$ end-member of the ludwigite-vonsenite series.

The X-ray diffraction pattern is very similar to those of other natural iron borates, such as "paigeite" from Kamaishi (Watanabe and Ito, 1954), "paigeite" from Crestmore (Thompson and Gower, 1954), and vonsenite from Jayville (Leonard and Vlisidis, 1961). Aside from some little differences which are probably due to variations in chemical composition, the results of X-ray analyses confirm those obtained from the chemical analyses: the Burguillos mineral is vonsenite.

We would agree with W. T. Schaller in Leonard and Vlisidis (1960) and use the term vonsenite for the Burguillos mineral, because of the lack of data on possible structural differences between the mineralogical species called paigeite and vonsenite.

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