Determination of the Elements in Ulexite, Tincal and Colemanite by ICP-OES Spectrometer

Y. Erdoğan, C. Yenikaya, N. Büyükkıdan, O. M. Kalfa
Dumlupınar University, Faculty of Art and Science, Department of Chemistry, Kütahya

ABSTRACT: Rare and the other elements in industrial boron minerals were determinated by various methods. In this study, element contents of ulexite (NaCaBsOg.SFtO), tincal (NaaB^.lOEkO) and colemanite (Ca2B60n.5H20) minerals were determinated by ICP-OES spectrometer in order to determine whether they have economical values or not.

1. INTRODUCTION

Ulexite, NaCaB509.8H20 is one of the member of the borate subsclasses like tincal and colemanite and crystallises in triclinic system. Its hardness is 2.5 with specific gravity of 1.955 g/mL. The colour of pure ulexite is white or gray to colourless. It is associated with colemanite, hydroboracide and probetite. It has little solubility in cold water but soluable in acid. Ulexite is found in Kırka, Bigadiç and Emet in Turkey and in Arjantina (DPT, "Kimya Sanayii Hammaddeleri", Sekizinci Beş Yıllık Kalkınma Planı, Madencilik Özel İhtisas Komisyonu Raporu, Ankara, 2001, Garret, D. E. "Borates Handbook of Deposits, Processing and Use", Academic Press, California).

Tincal, Na2B4O7.10H2O has a monoclinic crystal system with short and prismatic crystal habit. Its hardness is 2-2.5 with specific gravity of 1.715 g/mL. It is colourless and transparent, but it may have the colour of pink, yellow and grey.Tincal can change into tincalconite easily by dehydration. It is associated with borax, colemanite and hydroboracide. The occurrence of Tincal ores are in Eskişehir- Kırka (DPT, "Kimya Sanayii Hammaddeleri", Sekizinci Beş Yıllık Kalkınma Planı, Madencilik Özel İhtisas Komisyonu Raporu, Ankara, 2001, Garret, D. E. "Borates Handbook of Deposits, Processing and Use", Academic Press, California).

Colemanite, Ca2B60n.5H20 has a monoclinic crystal system with short prismatic crystal habit. Its hardness is 4-4.5 with specific gravity of 2.42 g/mL. It is transparent. Its colour is white to clear. It is rousted as powder when heated. It has a slow solubility in 20-25°C water but a good solubility in hot acid (HCl). Colemanite is used in boric acid and glass wool production industry. Colemanite is found in Kestelek, Bigadiç and Emet in Turkey and in USA (DPT, "Kimya Sanayii Hammaddeleri", Sekizinci Beş Yıllık Kalkınma Planı, Madencilik Özel İhtisas Komisyonu Raporu, Ankara, 2001, Garret, D. E. "Borates Handbook of Deposits, Processing and Use", Academic Press, California)

Analysis were done with ICP-OES spectrometer. ICP-OES Spectrometer itself is usually used to detect trace amounts of elements, which after being atomized and heated, show characteristic sharp emission lines.

2. MATERIALS AND METHOD

Tincal was supplied from Eskişehir-Kırka Boron Plant, ulexite was supplied from Balıkesir-Bigadiç Boron Plant and colemanite was supplied from Kütahya-Emet Boron Plant.

The samples were grinded and then solved properly (Erdoğan et all., 1998). Afterwards analyzed with

ICP-OES spectrometer.

3. **RESULTS AND DISCUSSION**

The results are shown in Table 1-3 above.

Table 1 Amounts of elements in tincal ore.

Element	Concentration (ppm)	Element	Concentration (ppm)
Dy	57830	Au	579.3
B	186700	V	2870
Ti	29.20	Yb	9.494
Bi	340.5	Er	
Cd		Zr	85.11
Ba	2102	Tl	
Co	91.58	Pb	798.1
Cs	2090	Li	410.14
U		K	27550
Nb		Ca	225400
Ru	2990	Sr	14590
Th	2182	Sc	11.57
W		S	44030
Be		Ni	151.3
P	6964	Cu	
Pt			

Table 2. Amounts of elements in ulexite ore.

Element	Concentration (ppm)	Element	Concentration (ppm)
Dy	5665	Au	569.5
B	145000	V	31330
Ti	132.6	Yb	2.304
Bi	1451	Er	
Cd		Zr	21.831
Ba	91.07	Tl	718.1
Co	45.17	Pb	
Cs	7248	Li	713.2
U		K	25380
Nb		Ca	31140
Ru		Sr	1794
Th	2197	Sc	12.65
W		S	21630
Be		Ni	172.8
P	6238	Cu	
Pt	1154		

Table 3. Amounts of elements in colemanite ore.

Element	Concentration (ppm)	Element	Concentration (ppm)
Dy	18380	Au	506.2
B	158000	V	2794
Ti	16.51	Yb	
Bi	993.3	Er	
Cd		Zr	74.29
Ba	3813	Tl	
Co		Pb	
Cs	1650	Li	407.1
U		K	4231
Nb		Ca	229400
Ru	3045	Sr	6166
Th	2290	Sc	21.49
W		S	23370
Be		Ni	153.6
P	6390	Cu	
Pt	919		

4. CONCLUSION

As seen from the results that, there are many rare and the other elements in ulexite, tincal and colemanite.Some of these elements are valuable. If the analyses of other ores are made, grade calculation can be done. If the elements have convenient concentration values, this is important for the development of Turkey. Because, there is no detailed ore plant and production of these elements in Turkey. In addition to this, we know from literature that, there is no enough research and knowledge about these strategic elements.

One of the basic aims of this study is to carry out the valuable and strategic elements from ulexite, tincal and colemanite. Rare earth element content possibilty of the samples increases the importance of the study. We got some results after the analysis of the samples. There is a necessity of quantative analysis by other techniques to make sure of the results of the research. In order to get correct results from ICP technique, enrichment of the analyzed elements must be done. For a more detailed result, the elements that can be analyzed by ICP-OES accept performed elements must be examined.

Turkey must make investment about these valuable elements and become a country which competes with other countries. For this purpose;

1. Searching of the minerals that includes rare earth elements must be accelerated.

2. For the usage of established elements in advanced technology, researchs must be supported. Research centers must be set.

3. The study that was applied to ores must be adapted to ore wastes.

4. At least one of these established elements in this study, whether its grade is convenient, is going to be a major subject for development of Turkey.

REFERENCES

DPT, "Kimya Sanayii Hammaddeleri", Sekizinci Beş Yıllık Kalkınma Planı, Madencilik Özel İhtisas Komisyonu Raporu, Ankara, 2001.

Garret, D. E. "Borates Handbook of Deposits, Processing and Use", Academic Press, California.

Y., Erdoğan, M., Aksu, A., Demirbaş, Y., Abalı, "Analyses of Boronic Ores and Sludges and Solubilities of Boron Minerals in QVsatureted Water", Resources, Conservation and Recycling 24, 275-283,1998.