



Mineral Elemental Characterization by Scanning Electron Microscopy of Samples of the Sierra De Pajacuarán, Mexico

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ABSTRACT

To search for possible presence of minerals of economic value a study of elemental chemical analysis was performed by scanning electron microscopy on samples of rock of the sierra de Pajacuaran, Michoacan. The result of the analysis indicates clearly abnormal values which may be indicative of a geochemical anomaly and the possible presence of minerals of economic value in the region.

KEYWORDS

mineral characterization, scanning electron microscopy

INTRODUCTION

A common practice in the evaluation of a mineral deposit, is the generic determination of the laws of the elements that may be relevant depending on the type of deposit. Against this background the analytical techniques of minerals that provide such results have acquired undeniable importance, one of these analytical techniques is both optical microscopy and the scanning electron (SEM), which may even be useful in the design of separation processes and removing an item of interest in the deposit studied (Melgarejo et al., 2010). The above process is based on the fact that determining properties of the degree of release of any rock component are mineral species, morphology and dimensions thereof (Andara et al., 2011)

SEM is based on obtaining an image of a sample obtained from scanning the same with an electron beam. The interaction between the incident electrons and the sample cause the emission of secondary electrons, backscattered electrons and X-rays characteristic of the elements present in the sample, which is exploited for the qualitative and semi-quantitative chemical analysis. In the SEM, different detectors collect and amplify the signal emitted by

the surface of the sample when it is scanned by the electron beam. The intensity of the amplified signal is displayed on a conventional screen. Recent advances in both equipment and software make this a potentially very powerful technique not yet widely used in earth sciences (Melgarejo et al., 2010) .n.

MINERALOGICAL STUDY OF ROCK SAMPLES OF THE SIERRA DE PAJACUARÁN BY SCANNING ELECTRON MICROSCOPY

To search for possible presence of minerals with economic value an elemental chemical analysis by scanning electron microscopy was performed by the method of comparison with a standard (Almagro, 1999), for rock samples of the sierra de pajacuarán that showed some remarkable crystals in its structure.

The equipment used was a JEOL scanning electron microscopy 6610OLV brand model.

The results of the samples are listed below:

Sample 1

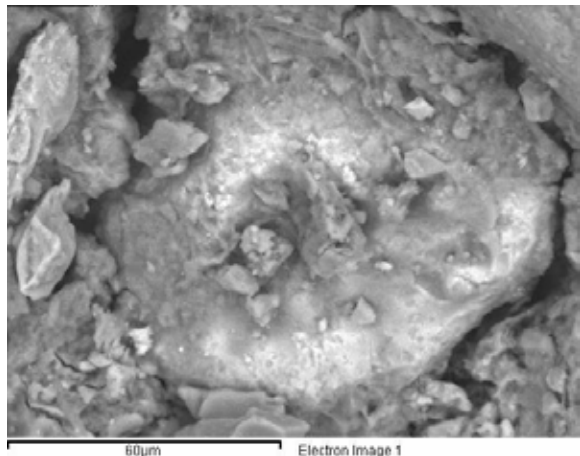


Figure 1: morphology of sample 1 rock of the sierra de Pajacuaran obtained by scanning electron microscope

Analysis technique: All elements analyzed (normalized)

Number of iterations: 4.

Standar:

- C CaCO3 1-Jun-1999 12:00 AM
- O SiO2 1-Jun-1999 12:00 AM
- Na Albite 1-Jun-1999 12:00 AM
- Mg MgO 1-Jun-1999 12:00 AM
- Al Al2O3 1-Jun-1999 12:00 AM
- Si SiO2 1-Jun-1999 12:00 AM
- P GaP 1-Jun-1999 12:00 AM
- S FeS2 1-Jun-1999 12:00 AM
- Cl KCl 1-Jun-1999 12:00 AM
- K MAD-10 Feldspar 1-Jun-1999 12:00 AM
- Ca Wollastonite 1-Jun-1999 12:00 AM
- Ti Ti 1-Jun-1999 12:00 AM
- Fe Fe 1-Jun-1999 12:00 AM

Table 1: Result of analysis of sample 1 rock of the sierra de Pajacuaran obtained by scanning electron microscopy.

Element	Weight%	Atomic%
C K	10.14	17.02
O K	46.13	58.16
Na K	0.92	0.80
Mg K	1.48	1.23
Al K	4.04	3.02
Si K	12.85	9.23
P K	1.48	0.97
S K	1.02	0.64
Cl K	0.43	0.25
K K	1.14	0.59
Ca K	3.29	1.66
Ti K	4.48	1.89
Fe K	12.58	4.54
Total	100.00	

Sample 2

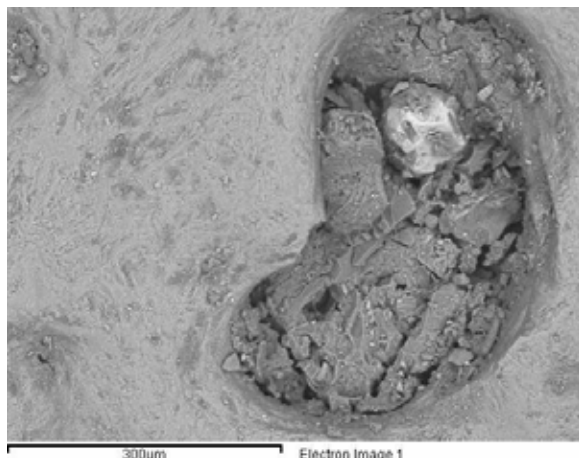


Figure 2: morphology of sample 2 rock of the sierra de Pajacuaran obtained by scanning electron microscope

Analysis technique: All elements analyzed (normalized)

Number of iterations: 5.

Standar:

- C CaCO3 1-Jun-1999 12:00 AM
- O SiO2 1-Jun-1999 12:00 AM
- Na Albite 1-Jun-1999 12:00 AM
- Mg MgO 1-Jun-1999 12:00 AM
- Al Al2O3 1-Jun-1999 12:00 AM
- Si SiO2 1-Jun-1999 12:00 AM
- P GaP 1-Jun-1999 12:00 AM
- S FeS2 1-Jun-1999 12:00 AM
- Cl KCl 1-Jun-1999 12:00 AM
- K MAD-10 Feldspar 1-Jun-1999 12:00 AM
- Ca Wollastonite 1-Jun-1999 12:00 AM
- Ti Ti 1-Jun-1999 12:00 AM
- Fe Fe 1-Jun-1999 12:00 AM

Table 2: Result of analysis of sample 2 rock of the sierra de Pajacuaran obtained by scanning electron microscopy.

Element	Weight%	Atomic%
C K	10.32	16.96
O K	48.28	59.60
Na K	0.95	0.82
Mg K	0.69	0.56
Al K	1.48	1.08
Si K	4.29	3.01
P K	9.66	6.16
S K	1.19	0.73
Cl K	0.29	0.16
K K	0.41	0.20
Ca K	19.75	9.73
Ti K	0.36	0.15
Mn K	0.39	0.14
Fe K	1.96	0.69
Totals	100.00	

Sample 3

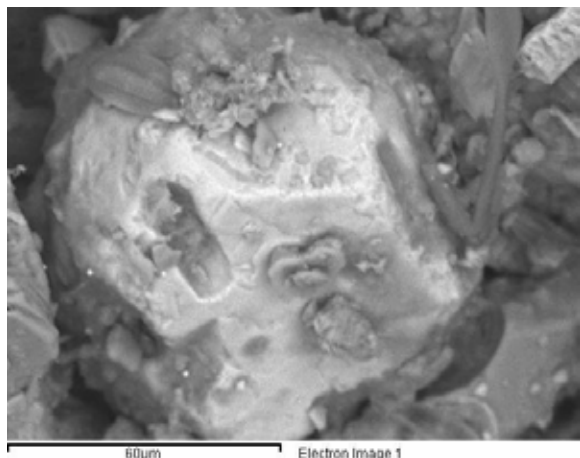


Figure 3: morphology of sample 3 rock of the sierra de Pajacuaran obtained by scanning electron microscopy

Analysis technique: All elements analyzed (normalized)

Number of iterations: 4.

Standar:

- C CaCO3 1-Jun-1999 12:00 AM
- O SiO2 1-Jun-1999 12:00 AM
- Na Albite 1-Jun-1999 12:00 AM
- Mg MgO 1-Jun-1999 12:00 AM
- Al Al2O3 1-Jun-1999 12:00 AM
- Si SiO2 1-Jun-1999 12:00 AM
- P GaP 1-Jun-1999 12:00 AM
- S FeS2 1-Jun-1999 12:00 AM
- Cl KCl 1-Jun-1999 12:00 AM
- K MAD-10 Feldspar 1-Jun-1999 12:00 AM
- Ca Wollastonite 1-Jun-1999 12:00 AM
- Ti Ti 1-Jun-1999 12:00 AM
- Fe Fe 1-Jun-1999 12:00 AM

Table 3: Result of analysis of sample 3 rock of the sierra de Pajacuaran obtained by scanning electron microscopy.

Element	Weight%	Atomic%
C K	6.58	12.86
O K	38.66	56.71
Na K	1.23	1.25
Mg K	0.77	0.75
Al K	2.10	1.82
Si K	7.40	6.18
P K	0.48	0.36
S K	1.27	0.93
Cl K	0.18	0.12
K K	0.48	0.29
Ca K	2.10	1.23
Ti K	17.25	8.45
Mn K	0.29	0.12
Fe K	21.23	8.92
Totals	100.00	

Sample 4

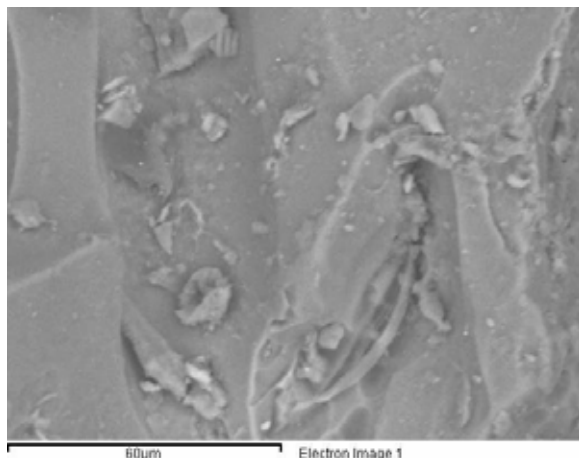


Figure 4: morphology of sample 4 rock of the sierra de Pajacuaran obtained by scanning electron microscopy

Analysis technique: All elements analyzed (normalized)

Number of iterations: 6.

Standar:

- C CaCO3 1-Jun-1999 12:00 AM
- O SiO2 1-Jun-1999 12:00 AM
- Na Albite 1-Jun-1999 12:00 AM
- Mg MgO 1-Jun-1999 12:00 AM
- Al Al2O3 1-Jun-1999 12:00 AM
- Si SiO2 1-Jun-1999 12:00 AM
- P GaP 1-Jun-1999 12:00 AM
- S FeS2 1-Jun-1999 12:00 AM
- Cl KCl 1-Jun-1999 12:00 AM
- K MAD-10 Feldspar 1-Jun-1999 12:00 AM
- Ca Wollastonite 1-Jun-1999 12:00 AM
- Ti Ti 1-Jun-1999 12:00 AM
- Fe Fe 1-Jun-1999 12:00 AM

Table 4: Result of analysis of sample 4 rock of the sierra de Pajacuaran obtained by scanning electron microscopy.

Element	Weight%	Atomic%
C K	12.19	18.35
O K	52.75	59.63
Na K	2.22	1.75
Mg K	0.40	0.30
Al K	4.53	3.03
Si K	23.38	15.05
S K	0.17	0.10
K K	2.17	1.00
Ca K	0.55	0.25
Fe K	1.65	0.54
Totals	100.00	

The analysis results of the rock sample of the sierra de Pajacuaran clearly indicates abnormal values which may be indicative of a geochemical anomaly and the possible presence of Fe and Ti minerals of economic value in the region (Gass et al., 2002; Viladevall, 2008).

CONCLUSIONS

By characterization with scanning electron microscopy, we can identify the presence of iron and titanium minerals in rock samples from the Sierra de Pajacuaran, Michoacan possible economic value.

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