Analysis method of nano-dispersed gold in minerals Research

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In recent years, research projects have been actively carried out by research institutes in various countries to determine the existence of nano-dispersed gold and other noxious gold and to increase the rate of mistakes of gold ore.

In some countries, JEM-1000 electron microscope observations of clay minerals based on water-borne moths have shown that gold grains with a size of several tens of nanometers are present in mucus.

In Korea, there are opinions that nano-dispersed gold exists, but very accurate data on scientific research results are rarely presented. [1, 2]

In the lecture, a reasonable analytical method for analyzing nanodisperse gold by using scanning electron microscope combined with energy dispersive X-ray analyzer is established, and its existence state (size, shape, distribution state , Compound state).

1. Analysis method

1) Analyzer

Quanta200-type scanning electron microscope combined with energy dispersive X-ray analyzer

2) Preparation of specimen

Hole

3) Analysis method

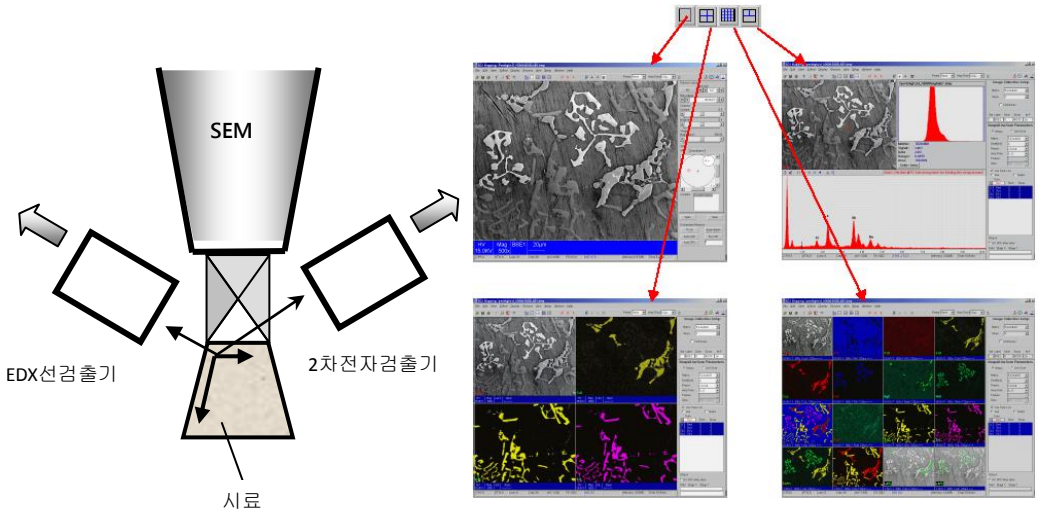
The analytical principle of EDX-coupled scanning electron microscopy (SEM) is shown in Fig.

As shown in the figure, the electron beam from the objective lens scans a certain area of the sample, and at every point there is a variety of information including characteristic X-rays and secondary electrons, reflection electrons, and electrons.

Here, the secondary electrons draw the image reflecting the concave / convex of the surface, and the characteristic X line draws the plane distribution diagram of the designated element.

On the right side of Figure 1, the angles show the shapes and distribution states in different colors, showing the distribution of the various elements specified.

The diameter of the electron beam to be scanned is 2 to 3 nm. If the characteristic X-ray energy range to be collected is selected as the energy range of the characteristic X-ray of gold, a gold distribution state diagram of up to 5 nm can be obtained.



A) B)

Figure 1. Principle of surface distribution analysis method of SEM combined EDX device
(A - analysis principle diagram, B - surface state distribution of various elements)

Figure 2 .shows the results of the point analysis on the mineral analyzed by SEM combined EDX device.

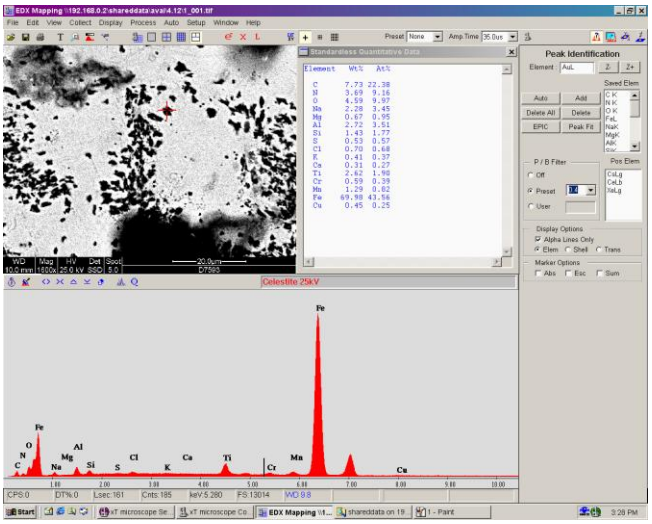


Figure 2. Microscopic analysis of SEM with EDX device

As shown in Figure 2, an SEM combining an EDX device can perform quantitative qualitative analysis of the material at any point while observing the image.

This analytical method can be used to analyze the state of nano-dispersed gold compounds.

4) Analysis form

Acceleration voltage 25KV,

The distance between the objective lens and the specimen is 10 mm,

The expansion magnification is 10,000 times,

Electron beam diameter 2 nm

2. Experimental Results and Interpretation

1) Reasonable characteristic X-ray confirmation of Au element

The results of EDX quantitative analysis of schistose minerals are shown in the following figure. Possible characteristics of the gold element The X-ray energy values and intensity are shown in the following table.

Table 1. Possible properties of gold elements X-ray intensity and intensity

Kinds	Energy,k□	century	Kinds	Energy,k□	century
$K_{\alpha 1}$	68.830	100.0	$L_{\beta 2}$	11.584	17.0
$K_{\alpha 2}$	67.003	50.0	$L_{\beta 3}$	11.608	6.0
$K_{\beta 1}$	77.652	26.9	$L_{\beta 4}$	11.204	4.0
$K_{\beta 2}$	78.062	11.1	$L_{\gamma 1}$	13.379	5.5
$K_{\beta 3}$	78.122	10.3	$L_{\gamma 23}$	13.708	1.5
$L_{\alpha 1}$	9.712	100.0	M_{β}	2.126	100.0
$L_{\alpha 2}$	9.627	10.0	M_{γ}	2.211	55.0
$L_{\beta 1}$	11.440	35.0	M_{γ}	2.413	3.2

As shown in the figure and table, the energies in which the characteristic X-rays of gold are shown are Au 9.712Kev, Au 9.627Kev, Au 2.126Kev, and the characteristic X-rays corresponding to the Au line among the elements present in the schist and saline are Au and Au There are no X-rays.

Therefore, the characteristic X-rays that can determine the distribution of gold are Au and Au lines.

2) Determination of the presence of gold in schist

The surface distribution of elemental elements for schistosome is analyzed and the results are shown in Fig.

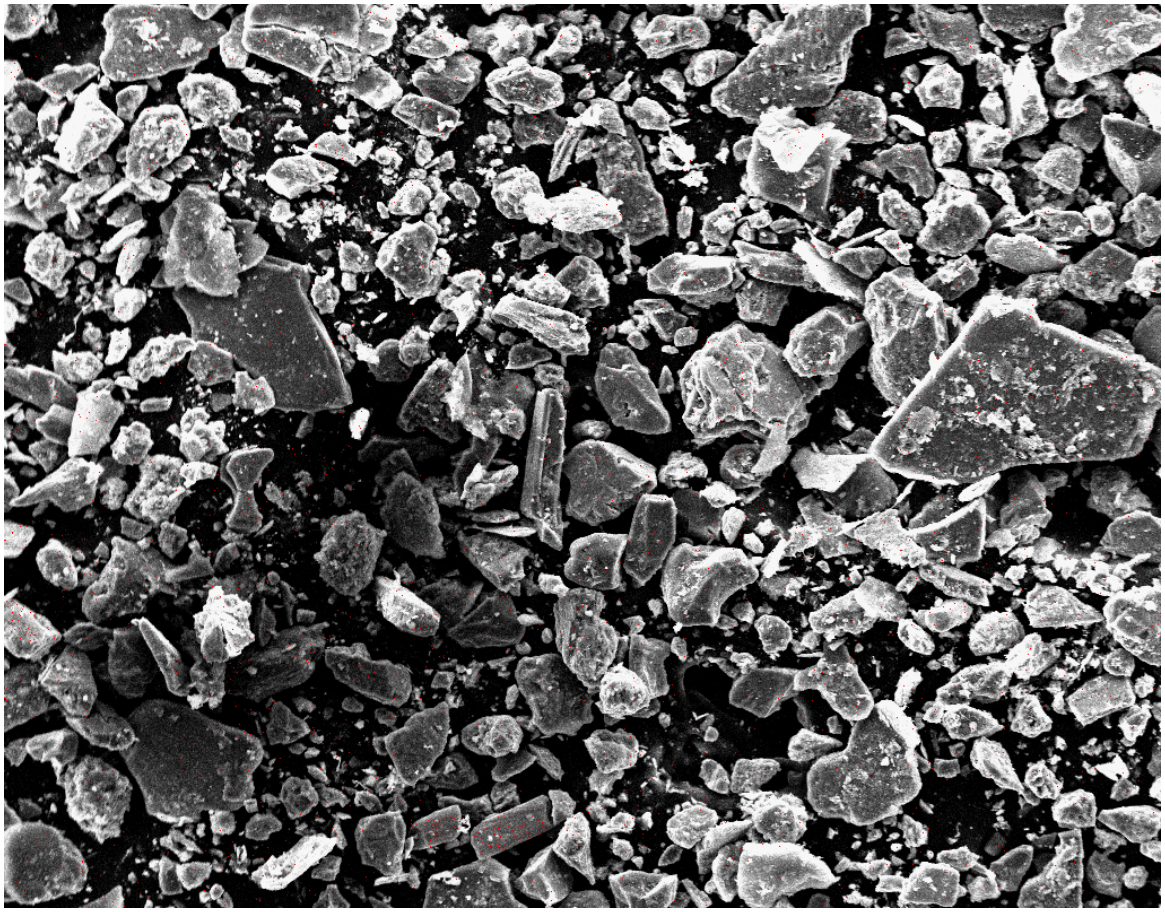


Figure 4. EDX surface distribution analysis of schist (2500 times magnification)

In the figure, we can observe the area where the analysis points are concentrated. We perform the micro-area analysis, the surface distribution analysis, and the point analysis on the area, and the results are shown in the following figure.

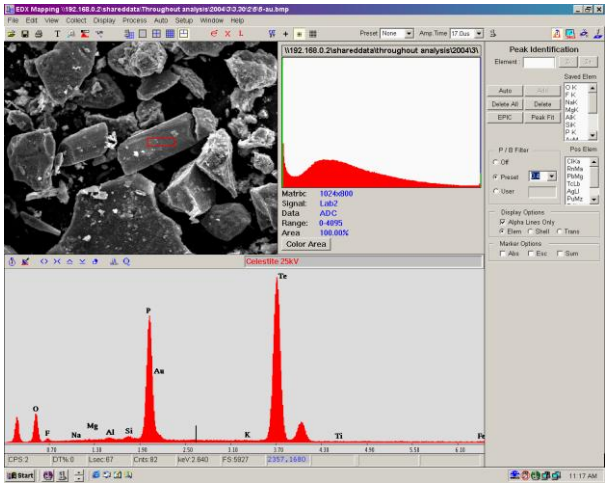


Figure 5. Minute area analysis results for concentrated areas (5000 times magnification)

From the results shown in Fig. 5, it can be seen that gold is concentrated in the mica of gold in the schist, and it exists in the form of AuTe2 compound, and its size is 5 to 20 nm, and the form is earthworm, polygon, rod type and the like. The content is 2 to 4 g / t.

Conclusion

1. The rational property X-ray of the Au element for the analysis of the EDX surface distribution in the schistose minerals was determined and the EDX surface distribution analysis method for the Au element was established.

A reasonable characteristic X-ray of Au is AuLα1 with an energy interval of 9.710 to 9.720 Kev.

2. The existence of gold was determined in schists.

In the schistose minerals, Au is concentrated in mica quality. The compound state is AuTe2, the size is 5 ~ 20nm, the form is earthworm, polygon, rod type and the content is 2 ~ 4g / t.

The presence of nano-dispersed gold in the mineral was determined using a scanning electron microscope coupled with an energy dispersive x-ray (EDX) analyzer.

References

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