MAP PRODUCTION FOR CALCITE MINERAL IN WEST OF IRAQ (WEST OF HOLY KARBALA) BY HYPERSPECTRAL IMAGE ANALYSIS WITH X-RAY TEST

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Abstract - Calcite is an important mineral in the glass industry. This research studied the initial investigation of Calcite mineral in the soil through remote sensing and product its distribution map to assist the researcher, investor and geologist in the investigation of minerals. The study area is located west of the holy city of Karbala, near Lake Razazah, where it is located in an important strategic area. The Hyperspectral image of study area that produced by the EO-1 satellite was used to detect Calcite metal by interpreting the image, which contains 242 bands, that increasing the difference and increasing the information extracted from the feature. The Spectral Correlation Mapper (SCM) technique was used in the Erdas program to determine the ratio of Calcite metal after image interpretation and determination of the Calcite region; the results of the interpretation were compared with the results of the laboratory by means of the X-ray test of soil samples that prove there is Calcite in study area.

Keyword – Hyperspectral, Erdas Software, SCM

I. INTRODUCTION

The minerals found in the soil are necessary materials that enter many industries that meet the needs of the society. It became necessary to explore these metals and know where they are. These minerals are Calcite metal.

The method of mineral investigate requires great field work for the great human effort, long period of time and the seriousness of the work and its problems. It is necessary to find new modern ways to investigate the metal, which facilitates many things in the study of researchers, the relevant authorities in the field of mineral investigation and industrial investors who rely mainly on minerals in their industries. These methods include the use of Hyperspectral images produced by specialized organizations in remote sensing by satellites or aircraft, where this image was processing and analysis by Erdas Imagine software to detect the Calcite mineral. [1]

II. AIM OF RESEARCH

The aim of this research is investigation of the Calcite mineral by used remote sensing also to:

1. Determine the location of the work and available areas of the Calcite mineral, which greatly facilitate the staff work.
2. Reduce the factor of time, effort and cost of the field work.
3. And, the analysis of hyperspectral images of metal detectors can be used to enter the field of investment by building plants according to minerals available in the soil.
4. Production map of Calcite mineral to help researcher, investor and the geologist in investigate at the mineral.

III. STUDY AREA

The study area is located to the west of the holy city of Karbala-Iraq, near Razazza Lake represented by the area that is subtracted from the Hyperspectral image (EO1H1690372006325110PM_1R) produced from Hyperspectral sensor on EO-1 satellite that is shown in figure (2). This area is characterized by abundance of mineral resources according to the previous geological studies and is also an important area because it is located on the main road linking the three provinces of holy Karbala, Al-Anbar and Al-Najaf Al-Ashraf.

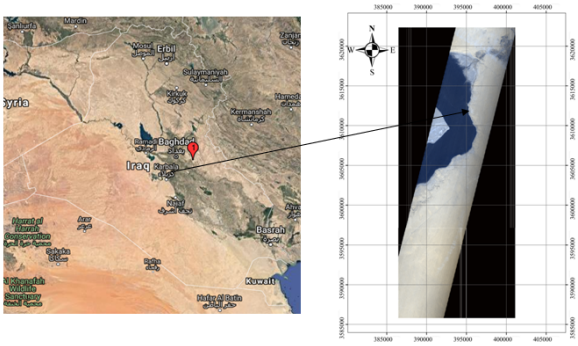
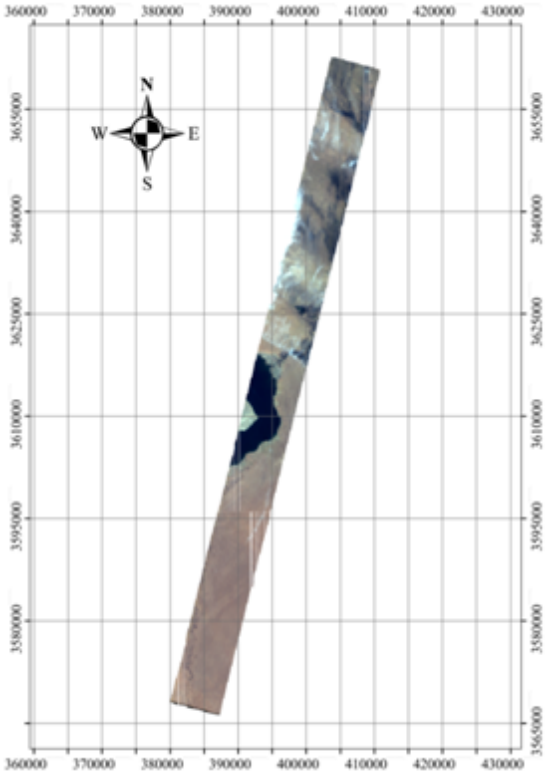


Fig. (2) Study area

1) Image processing

Image processing including geometric correction of image, bad band removal, spatial subset of image and atmospheric correction by use Internal Average Relative Reflectance (IARR) by using the Erdas

software. These corrections are very necessary to decrease the error of the analysis of image this image shows in fig(3).



Fig(3) Corrected image

2) Image analysis

For analysis the Hyperspectral image in Erdas software the Spectral Correlation Mapper (SCM) was used to detect the mineral and show mineral distribution on image where the value of SCM ranging between (1 to -1), the best value that gives indicated to mineral is zero or near to zero and this value give more matching to the reality.[3]

Six sites were selected on the image to determine the availability of Calcite metal using the SCM application. The results showed the existence of Calcite metal in the six locations as shown in table (1-2).

Site	N (m)	E (m)	SCM Value
1	3612469.43	396595.89	-0.023
2	3605840.10	394389.01	-0.041
3	3601602.61	393196.43	-0.036
4	3599210.12	392283.75	-0.039
5	3597428.57	389028.54	-0.033
6	3603548.07	396211.30	-0.043

Table (1-1) coordinates of sites

3) Ground Truth

For check the result of Erdas software must be done the ground truth, where ground truth including sample collection from six sites in the study area and they were tested in laboratory by using X-ray test device. The test was done for the six samples where the results showed the existence of the Calcite metal that shown in figures (4 to 9)

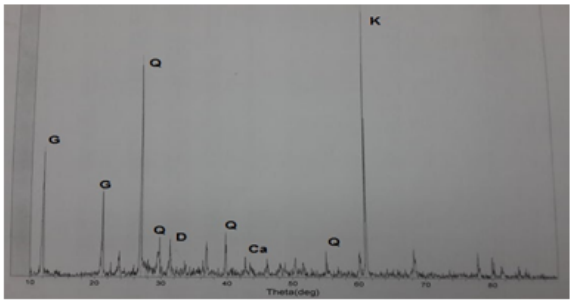


Fig.(4) X-ray diffraction analysis of the sample (1)

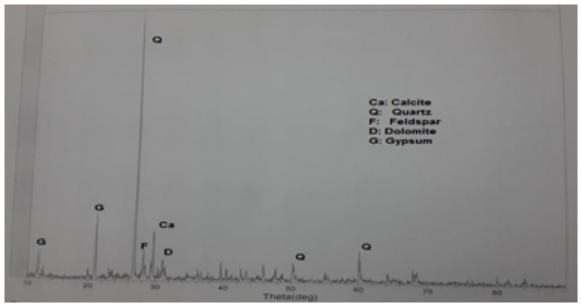


Fig.(5) X-ray diffraction analysis of the sample (2)

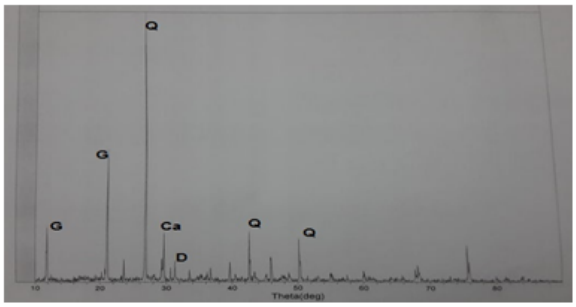


Fig.(6) X-ray diffraction analysis of the sample (3)

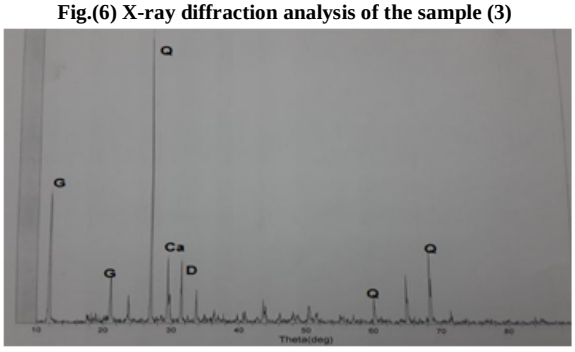


Fig.(7) X-ray diffraction analysis of the sample (4)

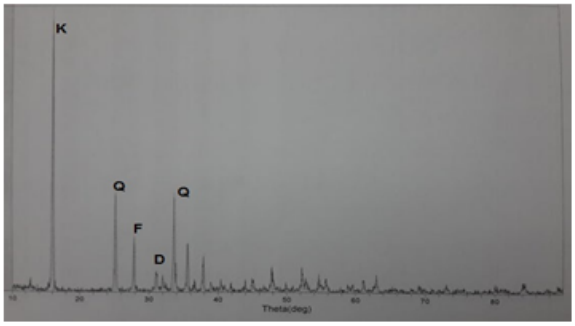


Fig.(8) X-ray diffraction analysis of the sample (5)

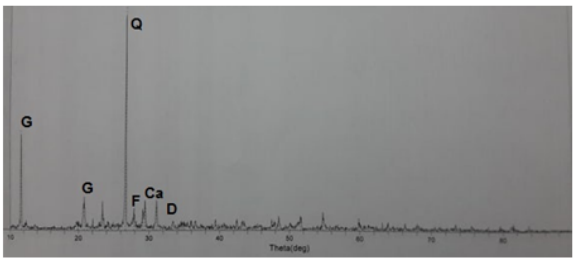
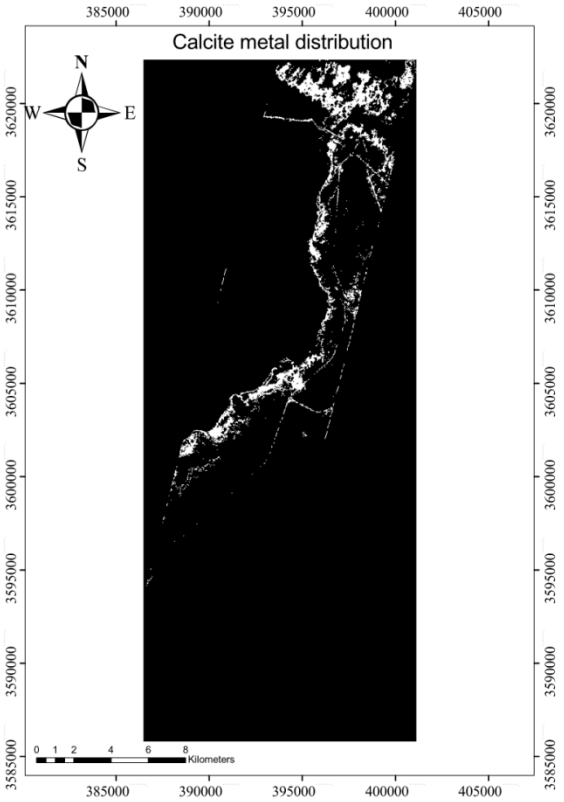


Fig.(9) X-ray diffraction analysis of the sample (6)

IV. RESULT

After conducting the ground truth process, which proved that the results of the Hyperspectral image analysis were identical to reality, a map (1) showing the distribution of Calcite metal was produced in the study area.

CONCLUSION



Map (1) Calcite metal distribution

1. The use of hyperspectral images contribute significantly to the primary detection of minerals through the production of maps related to the investigation of minerals and their areas of distribution, which can help the competent authorities, researchers and investors in their work, where this use contributes in to reduce the human effort and time period and reduce the risk during the mineral detection process.
2. The use of SCM technique for the production of maps indicating more distribution of mineral in the study area.
3. The results show a large spread of Calcite, which is used in many industries like the glass, and optics industries.

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