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SCANNING ELECTRON MICROSCOPE (SEM) TO EXAMINE CHARACTERISTICS PLANTS AND SOIL EVIDENCE IN BAGHDAD CITY, IRAQ

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Abstract

This study was conducted in the areas that were exposed to the events of explosions, terrorism and cemeteries for the purpose of identifying the forensic science environmental changes in criminal locations selected from Baghdad (two major areas of Baghdad city with control). Soil samples and two types of surrounding plants were collected in the region (*Ziziphus spina-christi, Eucalyptus camaldulensis*) in August 2018 and dried in the open air where the samples were divided on the basis of the necessary tests (digestion, extraction, and concentration). The samples were examined in the electronic microscope ESM to determine the shape of the fabric and the structure of the plant and the soil and its impact on the events. A comprehensive analysis of the images was given in measurements ranging from (100 to 1000) KX, where this geological examination of the initial composition of soil and plant In terms of changes and damage caused by the events, the samples were measured by EDX spectroscopy and allowed to measure the initial composition of the sample and trace behavior in plants and soil to study relationships with more detailed information regarding the natural characteristics of the study areas with the data presented on their impact on the causative agent.

Keywords: SEM analyses, Soil, Plant, Baghdad city

Introduction

The soil thin sections were analyzed with image analyzers previously (Murphy, 1977a, b; Pagliai *et al.,* 1983b, 1984). In the technique of image analysis to characterize soil structure by the quantification of soil porosity in all its aspects (pore shape, pore size distribution, irregularity, orientation, continuity, etc.) on thin sections, prepared from soil samples (Bouma *et al.,* 1977). This morphometric technique had the advantage that the measurement and the characterization of pore space can be combined with a visual appreciation of the type and distribution of pores in soil at a particular moment in its dynamic evolution and concerning sample preparation and image analysis, have improved the methods for direct quantification of soil pores. These processes allow the quantification of the effects of practices on soil porosity and structure (Mermut *et al.,* 1992; Moran and McBratney, 1992). The image analyzers perform lighter-electronic analysis of the image obtained using a macro epidiascope or light or electronic microscope, filmed with a video camera and shown on a monitor; the video signal passes through a processor that transforms the image into pixels and analyzes them individually depending on the grey level in each. Basic measurements of image analysis on pores include the number, area, diameters, perimeter, projections and these are supplemented by derived quantities such as shape factors, size distribution, irregularity, continuity, and orientation (Pagliai, 1988).

The thin sections can be examined by the SEM at several magnifications. For example, if the analysis in the image analyzer starts with BESI taken at x500 magnification, the size of the pixel will be 0.2 µm, therefore pores in the range of the storage pores 0.5-50 µm can be measured from the back-scattered electron scanning images (Pagliai and Vittori Antisari, 1993). The macroporosity the thin sections can be analyzed by a macro epidiascope and the image analyzer being set to measure pores larger than 50 µm. Two-dimensional images obtained can be transformed into data representing three-dimensional area percentages that are representative for three-dimensional volumes this process is called stereology techniques has been applied to achieve the soil objective (Mele *et al.,* 1999). Image analysis can be used not only on soil thin sections but also on polished faces of large soil blocks impregnated directly in the field with materials such as paraffin wax or resin (Moran *et al.,* 1989). stereology techniques to be true it is necessary for these pores to be homogeneously distributed in the soil matrix to determine their shape, width, and length of these pores, the analysis of pore patterns allows the characterization and prediction of flow processes in soils for roots growth and water movement. There are several studies showed the changes of pore size distribution at water content when the soil saturated water after the rain and the cracks are closed due to saturation changes in pore size distribution (Kutilek, 1996), the important aims that identify the changes that had happened in the environmental areas from various sites were chosen from the Baghdad (three main sites of Baghdad city to description of soils by the determination characterizing and locating the sources of soils to make forensic comparisons by Scanning Electron Microscope (SEM) to examine characteristics of Soil and plant .

Materials and Methods

Description and samples collection of the study area

Three sites were selected on the basis needed for full coverage affected areas to come from differently exposed to terrorism (cemeteries) and explosions as follows:

1- Al-Sadr City area where explosive equipment (Soil, Ziziphus spina-christi).

2- Al-Ghazali cemetery in near Sheikh Omar area (Soil, Ziziphus spina-christi).

3- University of Baghdad as a control area. (Soil, Soil, Ziziphus spina-christi).

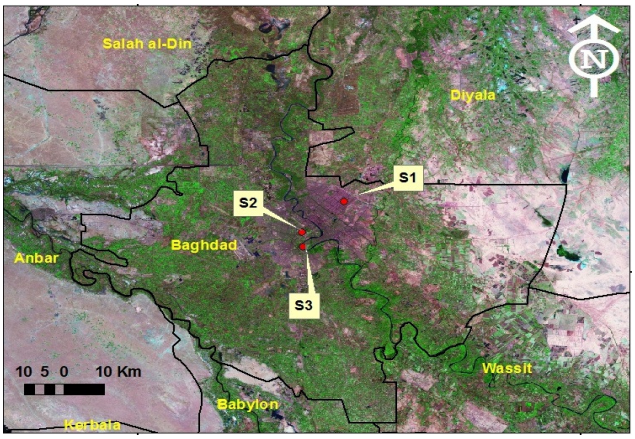

Fig. 1 : General Map to Shows study areas

Collection samples:

The samples were collected from the study areas during July in 2018. Five samples of each plant leaf were collected, then rinsed thoroughly with deionized water and dried outdoors at room temperature for 3-5 days, then grinded with a mill and sifted with a 1 mm diameter sieve to be ready for analysis. The total samples of the sites were 15 plant samples.

Five replicates soil samples were collected using clean polyethylene bags from a depth of (10-15) cm from random locations within each studied area and dried in the open air at room temperature for 5-7 days and then grinded by the mill (Planetary Ball Mill) and sifted with a 1 mm diameter sieve to be ready for image analysis.

Sample Preparation for Analysis by Scanning Electron Microscope

The morphology and composition of milled samples were characterized by SEM, It is based on scattered electrons that produced image of the sample surface and its composition and provides a three dimensional image system. The initial microscopic examination is usually done with a stereomicroscope at low magnification, typically 10X to 40X. This examination allows the forensic geologist to gain an overall impression of the soil specimen, note the presence and abundance of various natural and artificial non-mineral components such as seeds, bits of glass, plastic, or metal, and so on. The stereo microscope is used to view particles from as small as 10 micrometers (µm = 0.01mm) to as large as the physical capacity of the microscope stage. The eyepieces used for such examination often include a reticle that allows measurement of individual particles in the specimen, or a grid that simplifies counting individual particles in the specimen to provide the data necessary to determine particle size distribution.

Soil specimens to be examined are usually placed in a metal tray, white for dark specimens and black for light specimens, and examined by incident (reflected) light. The tray may also contain a comparison grid, and is often treated with a sticky substance to hold the particles in fixed positions while they are being examined and counted. Subsequent microscopic examination is usually done with a petrographic microscope, which is essentially a modified version of a standard compound biological microscope. A petrographic microscope makes provision for examining specimens by transmitted polarized light, and may also provide such features as an electrically-heated stage, which is used in determining the density and index of refraction of individual soil particles.

Results and Discussion

Have been stimulated the emission of characteristic X-rays from a plants and soil samples with high-energy beam of charged particles from electrons and atom within the sample in discrete energy levels number and measured by an energy-dispersive spectrometer. According to Joseph Goldstein, 2003 has been applied EDX and allowed the elemental composition of the specimen to be measured and track the behavior in plants and soils to examine the relationships with more detailed information concerning the natural properties of in the study sites with provided data concerning their impact on the factor causing the damage since the sites were aware of the prior effect source sample different of quantitative from explosions, terrorism and place cemetery, and a natural area as a control of the University of Baghdad station 3, therefore, the data is the scanning electron microscope examination gave us a clear vision and the data being no significant correlation for any sample in total contents and relative abundances as well as essential weather pollutants, these anions are the basic components of the natural earth material and secondly they may be added or mixed to soil such as the source of explosive materials, synthetic fertilizers or environmental pollution.

For three samples of different soil source and one type leaf plants have been given an overall observation image analysis gave clear result in measurement (1000) KX magnification was carried out in a region with dominant fabric was selected region with respect to the dimension of the scanned surface which is inspect (100) mm. In figure (2) the micrographs of control sample (S3 University of Baghdad) as for the sample of *Ziziphus spina-christi,* the clearest microscopic examination was clear micro fabric of this sample consists of granular arrangements with clean contacts. There are also some connectors between fabric. Some aggregations are also visible within the fabric, in Figure below shows microscopic image analyses of leaf *Ziziphus spina-christi* in 1000KX Magnifications at University of Baghdad.

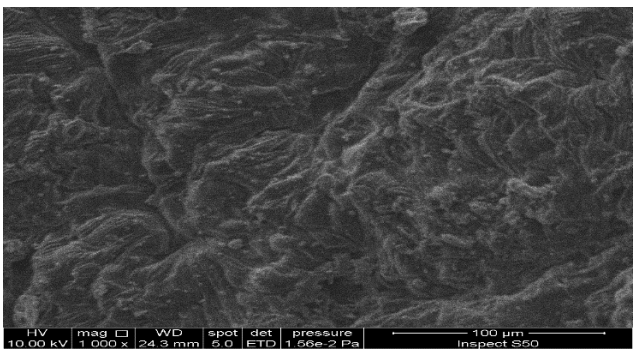

Fig. 2 : SEM Image analyses of *Ziziphus spina-christi* in 1000 KX Magnifications at University of Baghdad.

About image analyses in soil the micrographs of sample (S3 University of Baghdad) the micro fabric of this sample consists of granular arrangements with clean contacts. There are also some connectors between grains. Some aggregations are also visible within the fabric, some elementary particles and clean silt grains are easily seen It may have come from some pesticides and organic materials used by the university garden or from environmental pollution weathering, (3) SEM Image of Surface Soil In in 1000 KX Magnifications at University of Baghdad.

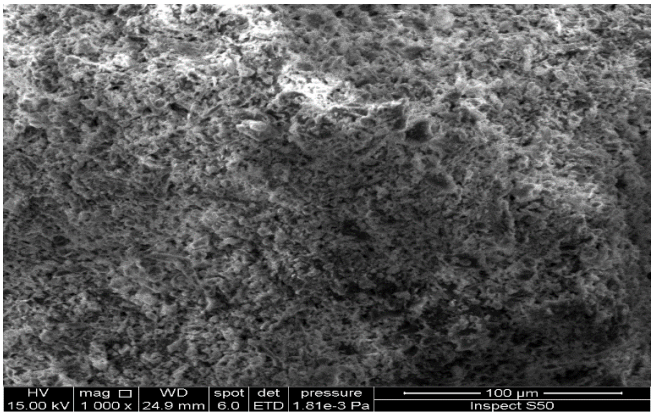

Fig. 3 : SEM Image analyses of Soil sample in university of Baghdad in 1000 KX Magnifications.

The micrographs of (S2 Al-Sadr City) Fig. (4) as for the leaf sample of *Ziziphus spina-christi,* the clearest microscopic examination of this sample consists of granular arrangements with not clean contacts. There are also some connectors between fabric and less visible than the control station (Baghdad university in S3) these samples were affected by the heavy dust caused by the explosion of the piles of gear and the microscopic vision was less clear, Figure (4) shows microscopic image analyses of leaf *Ziziphus spina-christi* in 1000 KX Magnifications at Al-Sadr City.

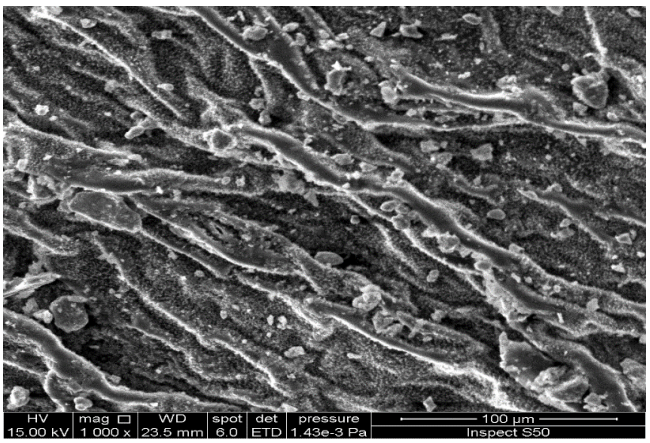

Fig. 4 : SEM Image analyses of leaf *Ziziphus spina-christi* in 1000 KX Magnifications at Al-Sadr City.

As illustrated in Figure (5) the microfabric of the soil samples (S1Al-Sadr City) comprises highly dense clay matrices with perturbed parallelism which contains very small intra-assemblage pore spaces and large inter-assemblage pore spaces of various shapes with more magnification and shows highly dense clay matrices with large inter-assemblage pore spaces and few intra-assemblage pore spaces which dominate the fabric this refers to the imbalance and damage that occurred after the explosion of small light weapons that occurred in June 2018, (5) SEM Image of Surface Soil In 1000KX Magnifications in S1 Al-Sadr City.

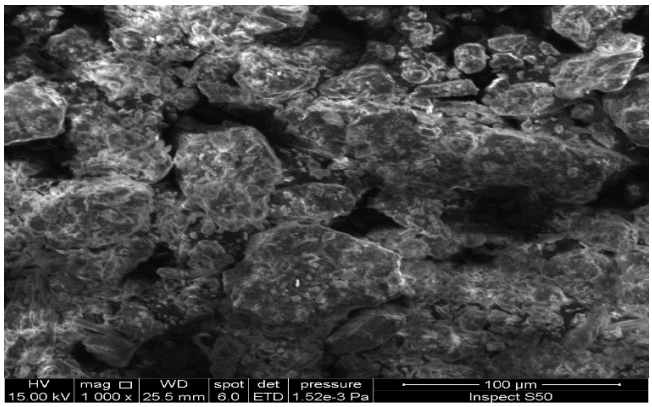

Fig. 5 : SEM image analyses of Soil sample of Al-Sadr City 1000 KX magnifications.

The microfabric of the sample (S2 Al-Ghazali cemetery) at a magnification range of 1000 XK Fig. (6) as for the leaf sample of *Ziziphus spina-christi,* the microscopic examination was little bit very clear because of organic matter absorbed by the plant at a magnification of the microfabric of this sample consists of granular arrangements with not clean contacts. There are also some connectors between the fabrics and less visible It was unclear in terms of the anatomical structure of the paper tissue. This indicates the extent of the plant leaf and the clogging of the holes with the dense dust due to continuous drilling of the soil from the landfill as well as the degradation of the organic matter inside the soil, which causes the appearance of the physiological characteristics and the nature of the absorption of plants, this agree with (**Patterson *et al*., 2006**).

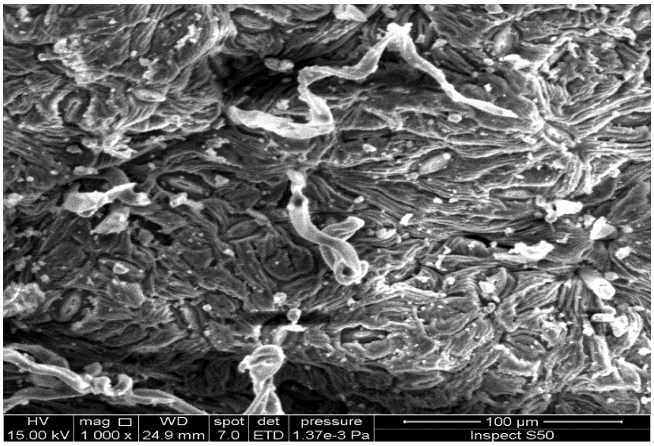

Fig. 6 : SEM Image analyses of leaf *Ziziphus spina-christi* in 1000 KX Magnifications at Al-Ghazali cemetery

Morphological changes in soil samples were evident in the microfabric soil samples in (S2 Al-Ghazali cemetery) consists mainly of clothed silt grains and more dense clay aggregations associated with inter-assemblage pore space , dense clay matrices overlapping with each other and clothed silt grains are clear to see and some elementary clay particle arrangements are also clear which is mainly consisted of dense clay matrices with inter-assemblage and intra-assemblage pore spaces within the fabric. Few regular aggregations are also visible. Some silt grains and regular aggregation are not good clear to see. As presented in Fig. 7 combination of dense and continuous clay matrices which have a preferred parallel arrangement forms the microfabric

of the continuous soil movement during the drilling and decomposition of the organic material quickly, this gives the impression of disturbing the soil on a daily basis or at least three times per week.

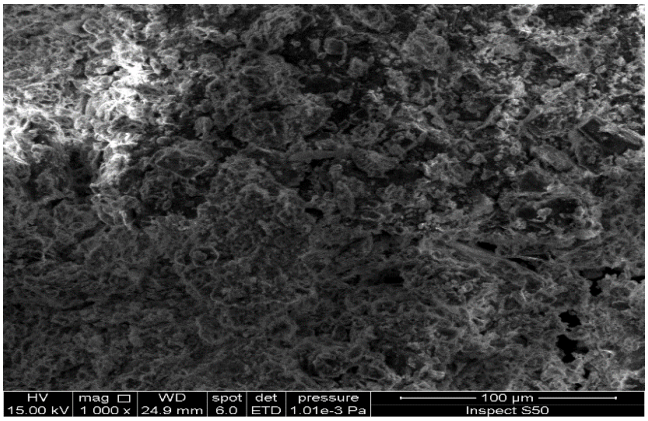

Fig. 7 : SEM image analyses of Soil sample in 1000, 2000, 5000 KX magnifications at Al-Ghazali cemetery.

Conclusion

In our results, the characterization of two types plants and soil have given detailed information depending structural conditions of climate and management data of soil physical. Hence, this system can be considered a good indicator of plants and soil quality and their impact according to the micro morphometric method to produce exhaustive information on actual soil quality by a fire, bombing, explosion and mass grave as in studies (Forensic Science, 2004; Eckert, 1997; Pagliai, 1988). This examination provided the forensic geologist in the preliminary structure of soil and plant in terms of changes and damage resulting from events overall impression of the soil specimen, contrary to examination in light microscopic as 40KX. This screening image analyses will supported us to know by counting setting and compare it with natural control without any effects from such as outer ring to the plants, large leaf, and soil characters, it is possible to label date the ring with the time it was formed dating can enable us to determine such things as stop growth, or the time a was damaged this corresponds to the study (Psillakis, 2000).

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