IRAQI Academic Scientific Journals

Samarra Journal of Pure and Applied Science

SJPAS

www.sjpas.com

p ISSN: 2663-7405
e ISSN: 2789-6838

Using Image J System to Process Ostracoda Images

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https://doi.org/10.54153/sjpas.2024.v6i1.708

Article Information

Received: 08/09/2023
Revised: 30/11/2023
Accepted: 04/12/2023
Published: 30/03/2024

Keywords:

Micropaleontology, Ostracoda, Duhok, Kolosh Formation, Image J System.

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Abstract

Image J system was used to process the different images of Ostracoda. As this system is considered one of the modern and advanced computer systems used in image processing. Image processing is one of the main branches of computer science and has developed in the current era as a result of the amazing development in computer and communication technologies. Micropaleontology is the systematic study of the morphology and classification of the microscopic fossils and their ecological, and stratigraphic importance. A microscope is the greatest tool for studying a microfossil's distinctive features because it is often tiny. Images of the Ostracoda were taken from the city of Duhok in Iraqi Kurdistan, from the Kolosh Formation, in which these species were studied and diagnosed. Seven species of ostracoda were obtained: *Gujaratella* sp. ,*Acanthocythereis hystrix* , *Alocopocythere gujaratensis* , *Alocopocythere* sp.1, *Alocopocythere fossularis* *Keijella* sp.1 and *Sulcostocythere* sp.1 The size of the original image was found and many manipulations and calculations were made, including finding the edges of the image, finding the length, height, area, perimeter and mean of the ostracoda image, and drawing the histogram of the original image. These calculations help in processing and analyzing images. This helps to shorten the time and effort of researchers in the field of geology.

Introduction

Paleontology is a branch of science that examines fossilized animals and plant remains, even tiny ones that have been preserved in rocks. It is concerned with all facets of the biology of prehistoric life forms, including their shapes, structure, evolutionary trends, taxonomic connections with each other and with present species, geographic distribution, and their interactions with the environment. Due to the significant role that fossils play in the identification and correlation of sedimentary layers, stratigraphy, and historical geology are mutually dependent on paleontology [1].

Paleontology is traditionally divided into various sub-divisions: Micropaleontology, Paleobotany, Palynology, Invertebrate Paleontology, Vertebrate Paleontology, Taphonomy, Ichnology, Paleoecology. Sediments from the Phanerozoic eon representing by Paleozoic, Mesozoic, and Cenozoic eras (dating from approximately 540 million years ago to the present) frequently contain microscopic fossils, such as ostracods, radiolaria, foraminifera, and diatoms. The study of the microfossils required an advanced high-resolution device known as

a scanning electron microscope (SEM) due to the very small size of the rock samples brought up from outcrops and subsurface sections. The strata of these eras have been subdivided in a noteworthy amount of detail according to the classification of microfossils of species that lived within terse time extent [2].

Ostracoda is one of the most important group in micropaleontology that is used to identify the paleoecology, paleogeography, paleoclimates and biostratigraphy, and it is characterized by the presence of various and multiple forms. Ostracoda is characterized by a bivalve carapace, a laterally compressed body, and left and right valves connected to each other by a hinge line in the dorsal region. The carapace comprises from inner lamella and outer lamella [3], The length of ostracoda ranges from 0.5 mm to 3 mm and is found in different environments such as fresh, brackish, saline and hypersaline waters. Some of which are benthic in their subsistence, and a few of them are roaming. It has a long stratigraphic range [4].

There are many shapes of ostracoda (Wedge, Boat like, Elongated (Sub rectangular), Kidney or Bean like, Ovate (Sub ovate) and Sub circular).
The body of the ostracoda is divided into three important parts: (Anterior, Thorax and Posterior) [5].

There are many margins of ostracoda found on the outside of the valve or carapace [6]

- Anterior: most broadly rounded.
- Posterior: narrower than the anterior margin.
- Dorsal margin: represent the upper part of ostracod, more it is straight or convex.
- Ventral margin: more concave in the mouth region.

There are three dimensions of ostracoda: (Length, Height and Width) [4-5].

- Length: is representing the distance between the farthest point on the anterior margin and the farthest point on the posterior margin and the greatest length always passes from the middle of the body or over the ventral margin, In most species of ostracoda, the length is greater than the height.
- Height: is representing the distance between the farthest point on the dorsal margin and the farthest point on the ventral margin and the greatest height always find at the near anterior.
- Width (thickness): is measured in the dorsal view, the width of the ostracoda is usually smaller than its length, greatest width always in posterior.

In this research, seven species of ostracoda were dealt with, because of its appearance in the
layers of the Kolosh Formation in the Duhok region:

- *Gujaratella* sp. [7] belonging to Family Hemicytheridae [8].
- *Acanthocythereis hystrix* [9-10]; Alocopocythere *gujaratensis* [7, 9]; Alocopocythere sp.1 [11]; *Alocopocythere fossularis* [7, 12]; *Keijella* sp.1; belonging to Family Trachyleberididae [9, 11].
- *Sulcostocythere* sp.1 [11] belonging to Family Cytheridae [11].

Methods

Images of the Ostracoda were taken from the city of Duhok in Iraqi Kurdistan, from the Kolosh Formation, in which these species were studied and diagnosed.

Image processing is one of the important and main branches of computer science (informatics), concerned with performing specific and specific operations on the original images with the aim of improving them according to specific criteria or extracting some information from them for the purpose of benefiting from them for later applications [13]. Each image is a two dimensional array of pixels according to the image size. There are three main types of digital images: Binary images, Gray scale images and Color images [14].

In this research, the Image J system was used, which is one of the most important and advanced computer systems that are widely used in image processing. It can display, edit, analyze, process, save, and print multiple images of different types [15]. It provides effort and time for the designers of systems and programs, which previously required the use of traditional and complex programming methods in solving various mathematical problems. In this research, we dealt with color images, as they are considered one of the most important types of images because they contain more important information than other types of images. [16].

The images were taken on ostracoda images, which represents the first process in image processing, and then many operations were performed on them for the purpose of studying, analyzing, and processing them, obtaining the dimensions of the images, and drawing the histogram for each image using modern computer methods represented by using the Image J program. This program is used in various fields of knowledge, such as geology sciences and its various branches, analyzing and processing images of various rocks [17].

The research dealt with processing images of ostracoda, which are microfossils, as many different procedures and calculations were implemented that could be useful in analyzing and processing images. These calculations help geologists know the dimensions, sizes, and features of the ostracoda, and this helps to shorten the time and effort of researchers in the field of geology.

There are many genera and species of ostracoda that are in different forms (ovate, elongated, kidney, wedge, sub rectangular, sub quadrate and sub circular) [4], and in order to identify them more clearly, see their details and process them, the Image J system was used, which is one of the most advanced and effective computer systems, and is used in many different fields and sciences.

Result and Discussion

In this research, seven different forms of ostracoda were dealt with, including: (*Gujaratella* sp., *Acanthocythereis hystrix, Alocopocythere gujaratensis, Alocopocythere* sp.1, Alocopocythere *fossularis, Keijella* sp.1 and *Sulcostocythere* sp.1) as shown in Plate 1.

The ostracoda is obtained from sedimentary rocks, as the model was taken and several operations were performed on it, represented by crushing the model into small pieces of 1 centimeter size and placing them inside a baker containing water or dilute hydrochloric acid, then after that they are placed on a quiet fire with continuous stirring with by adding water continuously and using filter paper and sieves, ostracodes are obtained and examined under a microscope.

The ostracoda is characterized by the presence of many colors. In the natural state, the color of the ostracoda shell is white to light yellow, but when the color of the shell is red, this indicates the presence of an oxidizing environment, and in the case of the color of the ostracoda being black, it indicates a reductive environment.

Image J system was used to find edge detection and measure length, height, area, perimeter and mean of the ostracoda original image as show in Table 1, histogram was drawn for the original images of ostracoda as shown in Fig. 1.

Plate 1

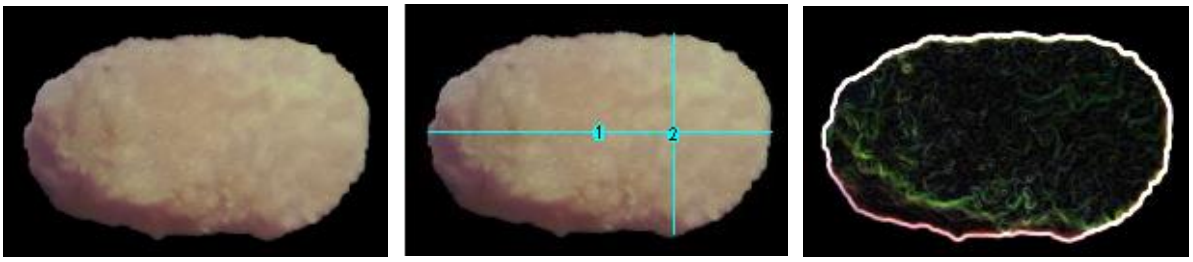


Image 1 (Original) *Gujaratella* sp. | Find Length and Height | Find Edge Detection (Area and Perimeter)

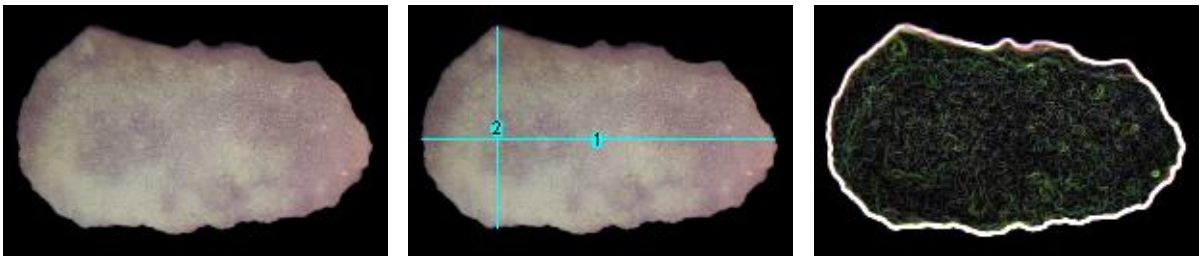


Image 2 (Original) *Acanthocythereis hystrix* | Find Length and Height | Find Edge Detection (Area and Perimeter)

Image 3 (Original) *Alocopocythere gujaratensis* | Find Length and Height | Find Edge Detection (Area and Perimeter)

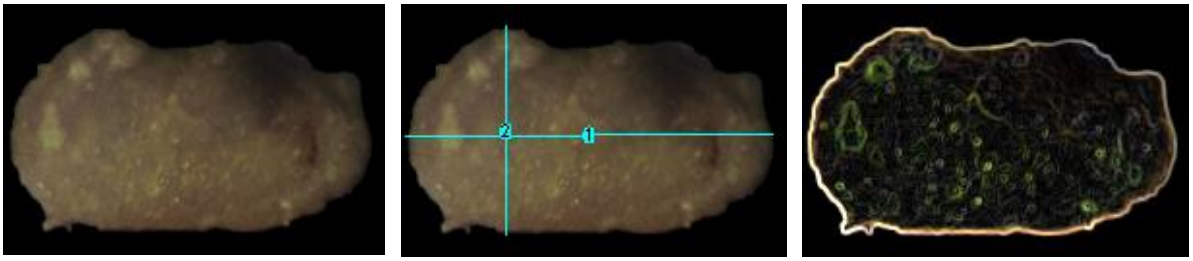


Image 4 (Original) *Alocopocythere* sp.1 | Find Length and Height | Find Edge Detection (Area and Perimeter)

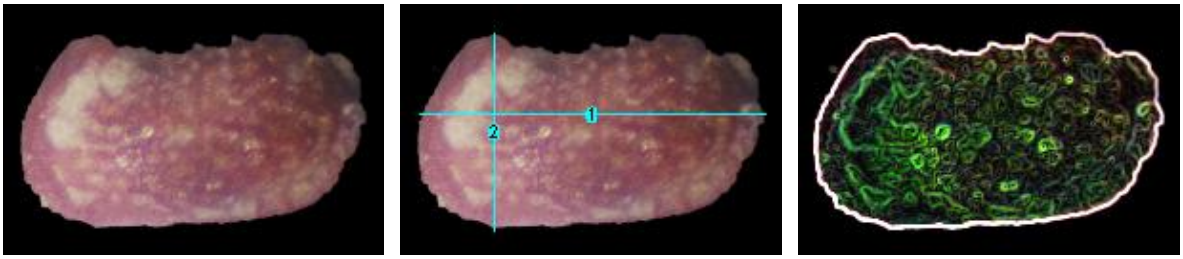


Image 5 (Original) *Alocopocythere fossularis* | Find Length and Height | Find Edge Detection (Area and Perimeter)

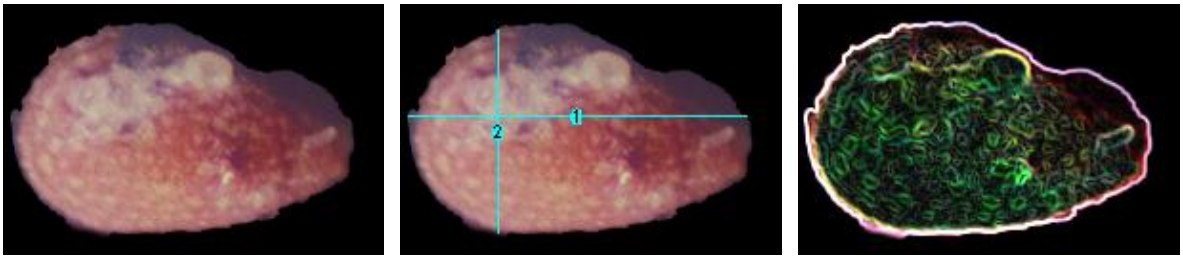


Image 6 (Original) *Keijella* sp.1 | Find Length and Height | Find Edge Detection (Area and Perimeter)

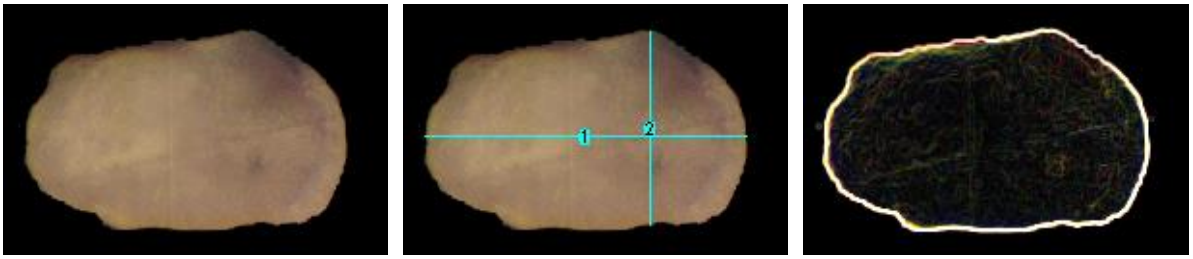
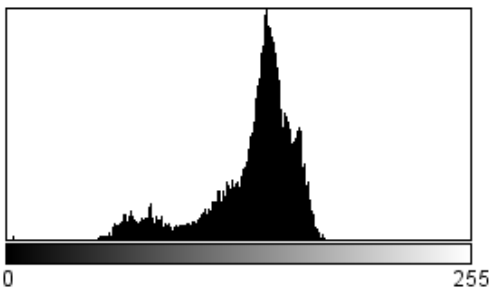


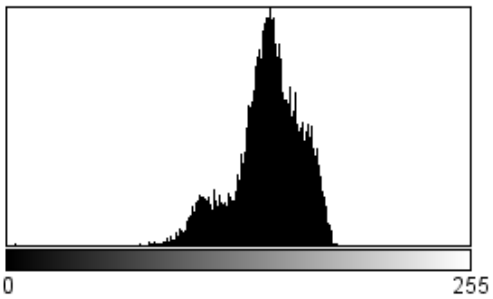
Image 7 (Original) *Sulcostocythere* sp.1 | Find Length and Height | Find Edge Detection (Area and Perimeter)

Table 1: Represent measure Length, Height, Area, Perimeter and Mean of the Images of Ostracoda

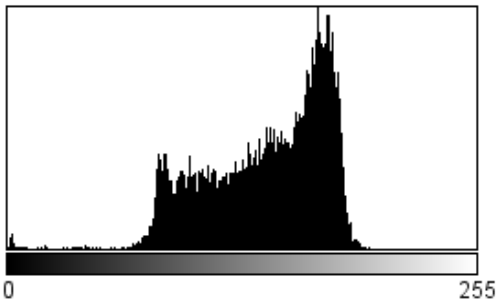
Image of Ostracoda	Size	Length	Height	Area	Perimeter	Mean
Image 1- *Gujaratella* sp.	200,130	179	104	15246	482	132
Image 2- *Acanthocythereis hystrix*	200,130	183	104	13967	485	142
Image 3- *Alocopocythere gujaratensis*	200,130	174	113	15191	488	139
Image 4- *Alocopocythere* sp.1	200,130	190	108	15760	529	71
Image 5- *Alocopocythere fossularis*	200,130	181	103	14388	487	115
Image 6- *Keijella* sp.1	200,130	177	106	14176	471	122
Image 7- *Sulcostocythere* sp.1	200,130	167	100	13901	457	116



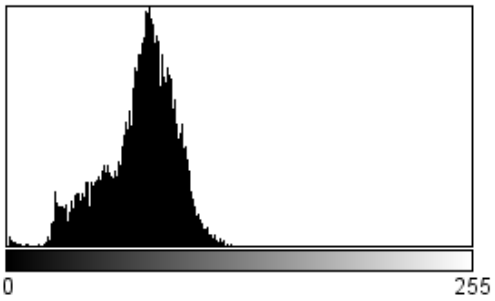
Histogram of Image 1



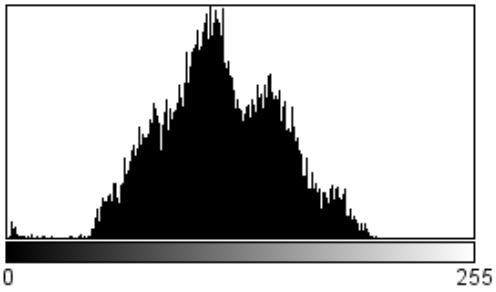
Histogram of Image 2



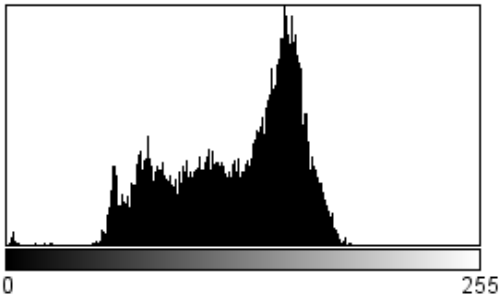
Histogram of Image 3



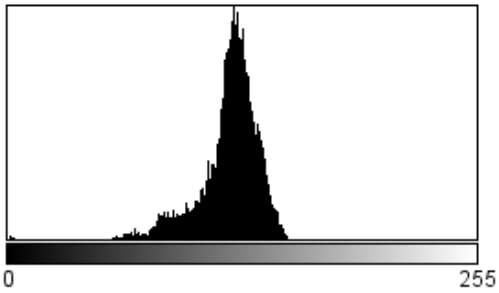
Histogram of Image 4



Histogram of Image 5



Histogram of Image 6



Histogram of Image 7

Fig. 1 Represent Histogram of Original Images of Ostracoda

Conclusions

In this research, a number of important points were concluded that can be summarized as follows:

- The ornamentation was seen in the images of the ostracode, which is one of the

external features that we observe on the outer surface of the valve, which is not reflected on the inner surface. There are many types of ornamentation including smooth, spines, tubercle, reticulation, pits and ridges

- It was noted that most of the images of ostracoda that were dealt with in the research have the anterior wider than the posterior, and thus the ostracoda is able to resist the conditions surrounding it
- Image J system was used, which is one of the latest and most important computer systems used in image processing. Ostracoda images were process by measured finding the edges of the image, length, height, area, perimeter and find mean of pixel values in the image
- In this research, the ostracode shell appeared in different colors, including white, light yellow, and red, and each color indicates a specific environment.
- Histogram of ostracoda original image was drawn, which helped analyze and process the images, and through the histogram that was drawn for the Ostracoda images, it was concluded that whenever the intensity values of pixels were close to 0, the image was darker, and whenever the intensity values of pixel values were close to 255, the image was light

Aknowledgments: The author is very grateful to the University of Mosul College of Science for their provided facilities, which helped to improve the quality of this work.

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SJPAS
مجلة سامراء للعلوم البحتة والتطبيقية
www.sjpas.com
p ISSN: 2663-7405
e ISSN: 2789-6838

استخدام نظام Image J لمعالجة صور الاوستراكودا

لمى حازم خروفة
قسم علوم الارض، كلية العلوم، جامعة الموصل، العراق

معلومات البحث:
تأريخ الاستلام:2023/09/08
تاريخ التعديل : 2023/11/30
تأريخ القبــول: 2023/12/04
تاريخ الـنشر: 2024/03/30
الكلمات المفتاحية:
المتحجرات الدقيقة، الاوستراكودا، دهوك، تكوين كولوش ، نظام Image J

معلومات المؤلف

الايميل:
الموبايل:

الخلاصة:
تم استخدام نظام Image J لمعالجة الصور المختلفة للاوستراكودا حيث يعتبر هذا النظام من أنظمة الكمبيوتر الحديثة والمتطورة المستخدمة في معالجة الصور. تعد معالجة الصور أحد الفروع الرئيسية لعلوم الكمبيوتر وقد تطورت في العصر الحالي نتيجة للتطور المذهل في تقنيات الكمبيوتر والاتصالات. علم المتحجرات الدقيقة هو الدراسة المنهجية لمورفولوجيا وتصنيف المتحجرات المجهرية وأهميتها البيئية والطباقية. يعد المجهر من اهم الادوات المستخدمة لدراسة الصفات المميزة للمتحجرات الدقيقة. تم أخذ صور الأوستراكودا المستخدمة في البحث من مدينة دهوك في كردستان العراق، من تكوين كولوش، وقد تم دراسة وتشخيص هذه الانواع. حيث تم الحصول على سبع انواع من الاوستراكودا:
Gujaratella sp. ,*Acanthocythereis hystrix* , *Alocopocythere gujaratensis* , *Alocopocythere* sp.1, *Alocopocythere fossularis*, *Keijella* sp.1 and *Sulcostocythere* sp.1
تم ايجاد حجم الصورة الأصلية و إجراء العديد من المعالجات والحسابات، بما في ذلك العثور على حواف الصورة، وإيجاد الطول والارتفاع والمساحة والمحيط ومعدل القيم اللونية في الصورة، كما تم رسم المخطط البياني للصورة الأصلية. تساعد هذه الحسابات في عملية معالجة الصور وتحليلها. وذلك يساعد على اختصار الوقت والجهد للباحثين في مجال علوم الارض.