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First record of the species Aubignyna perlucida in Basra marshlands sediments/ southern Iraqi

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ABSTRACT

The research focused on the identification of a newly recorded species in Iraq, particularly in the southern region, through the collection of fifteen samples from seven locations within the Basra Governorate, situated northwest of Al Shafi District. The sediment types of these samples were analyzed, alongside the identification of foraminifera species and their relative abundance in the area under investigation. The grain size analysis of the sediments revealed the presence of four sediment types: mud, clay, sandy silt, and sandy mud, with mud being the predominant type in the region. The identified foraminifera species was Aubignyna perlucida, a benthic foraminifera that inhabits brackish to marine environments.. Its presence in the study area serves as significant environmental evidence of the marine influence on southern Iraq, particularly within the sediments dating back to the Late Holocene epoch.

1. Introduction

The Southern Marshes of Iraq, situated mainly in the south Mesopotamian basin, are formed by the Tigris and Euphrates rivers. Historically, these marshes represented the most extensive wetland ecosystem in Western Eurasia, distinguished by a intricate system of interlinked lakes and marshy areas. Over the course of the Holocene epoch, these marshes have experienced significant ecological transformations, driven by variations in climate, human interventions, and sedimentation dynamics[1]. The Early Holocene epoch was characterized by a shift from the wetter conditions prevalent during the Late Pleistocene to a drier climate. This change in climate brought about considerable modifications in river pathways and the development of back swamps. Notably, during phases of heightened humidity approximately 6,000 years ago, marine transgressions played a crucial role in sediment deposition, leading to the establishment of brackish-water environments that added to the intricate nature of the hydrological landscape[2]. Research focusing on Holocene paleoecology has revealed insights into the environmental conditions of these marshes. The study analysing foraminifera assemblages have provided valuable information regarding past salinities and ecological conditions. This is crucial for understanding the ancient environmental changes[3].Where the variety and composition of foraminifera species can offer valuable information regarding past climatic conditions and habitat preferences, as they serve as indicators of particular marine or freshwater

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environments. This enables the deduction of historical transformations in aquatic ecosystems and climate patterns [3][4].

Foraminifera are sensitive to environmental changes, making them excellent indicators of past conditions. This is particularly useful in identifying shifts in marine habitats. So that the recording of a species' first appearance in the sediments of an area can indicate significant ecological or environmental changes. This can be pivotal in understanding the timing and nature of these changes and this is the primary aim of the present study.

2. Materials and Methods

The study was conducted in August 2023 in the southern region of Iraq, specifically within the Basra Governorate, to the northwest of Al Shafi District which is located between latitudes (30º49' N and 30º52'N) and longitudes (47º24'E and 47º32'E), as illustrated in Figure (1). Fifteen sediment samples were obtained from seven locations using a shovel, with depths varying from 0.45 to 1.80 meters. To determine the types of sediments present at the study sites, 100 grams were collected from each sample, and a grain size analysis was carried out through wet sieving using a 0.0625 mm sieve. This method was employed to separate sand from silt and clay, followed by a Pipette analysis in accordance with [5].

In the examination of foraminifera species, wet samples underwent a washing process through a 0.0625 mm sieve to eliminate silt and clay. Following this, the samples were dried, and the foraminifera species were carefully selected and affixed onto slides for identification, which was conducted using a binocular stereoscopic microscope. Imaging of the species was performed with a scanning electron microscope, specifically the FE-SEM Nova Nano SEM 450. The taxonomic classification of the foraminifera primarily relied on the work of [6], supplemented by the contributions of [7,8,9,10,11,12,13]. The categorization of elevated taxonomic categories was conducted utilizing [14].

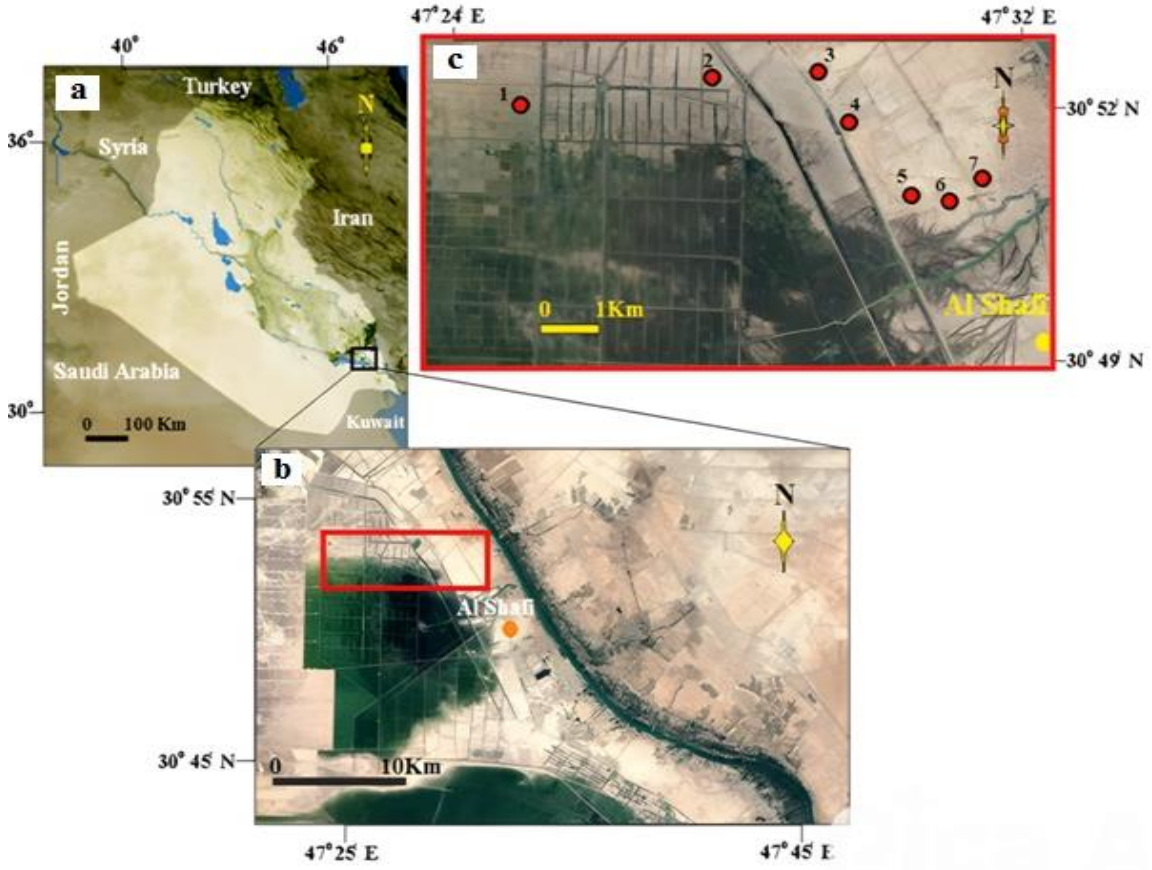

Fig.1. Satellite image for Location and Sampling map of the study area, (a) map of Iraq. (b)the study area. (c) the sampling locations.

3. Results

3.1. Sediments type

The findings from the grain size analysis, based on the classification established by [5] and presented in Table 1, indicate that mud sediment constitutes a significant portion of the study area, accounting for approximately 67%. In contrast, clay and sandy silt each represent 13% of the sediment composition, while sandy mud comprises 7%.

The variation in sediment texture within the region, along with the predominance of certain types, suggests that the study area is characterized by a low-energy sedimentation environment. This depositional setting is likely fluvial, incorporating a combination of aeolian and marine sediments [15][16].

Table 1. Sediment texture and the relative abundance of Aubignyna perlucida and other foraminiferal species observed in the study area locations.

Site	Sample depth (m)	Sediment texture	Foraminifera species				
			Aubignyna perlucida	Ammonia beccarii	Ammonia tepida	Elphidium incertum	Elphidium poeyanum
1	0.45	Mud	80	5	10	3	2
	1.50	Clay	86	3	9	2	0
2	0.75	Mud	90	2	6	1	1
	1.40	Clay	85	5	10	0	0
3	0.50	Mud	87	6	7	0	0
	1.00	Mud	90	3	5	0	2
4	0.75	Mud	80	8	9	1	2
	1.80	Mud	89	1	10	0	0
5	0.55	Sandy silt	70	11	14	2	3
	1.30	Mud	84	4	12	0	0
6	0.70	Sandy silt	76	10	12	2	0
	1.60	Mud	86	3	9	1	1
7	0.75	Sandy mud	75	8	15	0	1
	1.20	Mud	77	5	17	0	1
	1.80	Mud	81	6	10	2	1

3.2. Foraminiferal analysis

The Foraminifera species Aubignyna perlucida was notably prevalent in the study area, demonstrating a significant dominance over the other foraminiferal species, as shown in Table 1. The identification of these foraminifera species is depicted in Figure 2, along with the corresponding classification outlined below.

Kingdom: Chromista Cavalier-smith, 1981

Subkingdom: Harosa Cavalier-smith, 2010

Infrakingdom: Rhizaria Cavalier-smith, 2002

Phylum: Foraminifera d'Orbigny, 1826

Class: Globothalamea Pawlowski, Holzmann and Tyszka, 2013

Subclass: Rotaliana *Mikhalevich*, 1980.

Order: Rotaliida Delage and Hérouard, 2013

Suborder Rotaliina Delage and Hérouard, 1896

Superfamily Chilostomellacea Brady, 1881

Family Trichohyalidae Saidova, 1981

Genus Aubignyna Margerel, 1970

Aubignyna perlucida (Heron-Allen & Earland, 1913)

(Figure 2)

1913 Rotalia perlucida sp. nov. Heron-Allen and Earland: 139, pl. 13, figs 7-9.

1969 Buccella planidorso sp. nov. Atkinson: 535, fig. 6.3a-c.

1970 Aubignyna mariei sp. nov. Margerel: 60-64, pl. 1, figs 1-8, pl. 2, figs 1-10, text-fig.2.

1987 Aubignyna perlucida . Yanko and Troitskaja, p. 36, pl. 7, fig.6-9; pl. 8, fig.1.

1999 Aubignyna perlucida (Heron-Allen and Earland). Hayward et al., p. 162, pl. 16, fig.1-3.

2000 Aubignyna perlucida (Heron-Allen and Earland). Murry et al., p. 66, pl. 1, fig.1-14.

2002 Aubignyna perlucida (Heron-Allen and Earland). Kaminski et al., p. 176, pl. IV., fig.8-9.

Remarks: The test is free and trochospiral in shape, featuring a flattened spiral side that consists of no more than one and a half whorls, with the final whorl containing seven chambers. The proloculus is notably large, and the sutures are characterized by a curved, oblique, and slightly depressed appearance. The chamber walls are smooth, while the periphery is rounded with sides that are more or less parallel. On the umbilical side, there are also seven chambers, with sutures that are curved, swept back, and incised towards the umbilical end. The umbilicus is star-shaped, with granular material extending along the sutures, although the chamber walls remain smooth otherwise. The aperture is an interiomarginal slit, partially obscured by granules, extending from the umbilicus nearly to the spiral side, and the wall is hyaline and perforate.

Distribution: A species native to southern Europe, specifically the Lusitanian region, inhabits shallow marine and estuarine environments, with its distribution recorded in northwest France, southwest England (notably Devon and Cornwall), and western Ireland. Therefore, its presence in Pleistocene sediments found in the UK, such as those from the Kirmington Formation in eastern England, would indicate that the interglacial conditions during that epoch were warmer than those experienced in the present day. Additionally, this species has been identified in late Pliocene deposits in northwest France documented by Margerel in 1970[10].

The species has also been recorded in Quaternary sediments located in Poland (Brachlewo), Germany, the Netherlands, and Italy. Additionally, it has been identified in Recent sediments found in the Mediterranean, Adriatic, and Black Seas [7].

Environmental conditions: Aubignyna perlucida has demonstrated its ability to thrive in both brackish and standard marine environments, showcasing its resilience to varying salinity conditions. This species is commonly located in protected areas of estuaries, such as behind mangrove or marshlands, where sediment tends to accumulate and wave disturbances are reduced, particularly in shallow waters of estuaries and lagoons that are less than 6 meters deep [6][18].

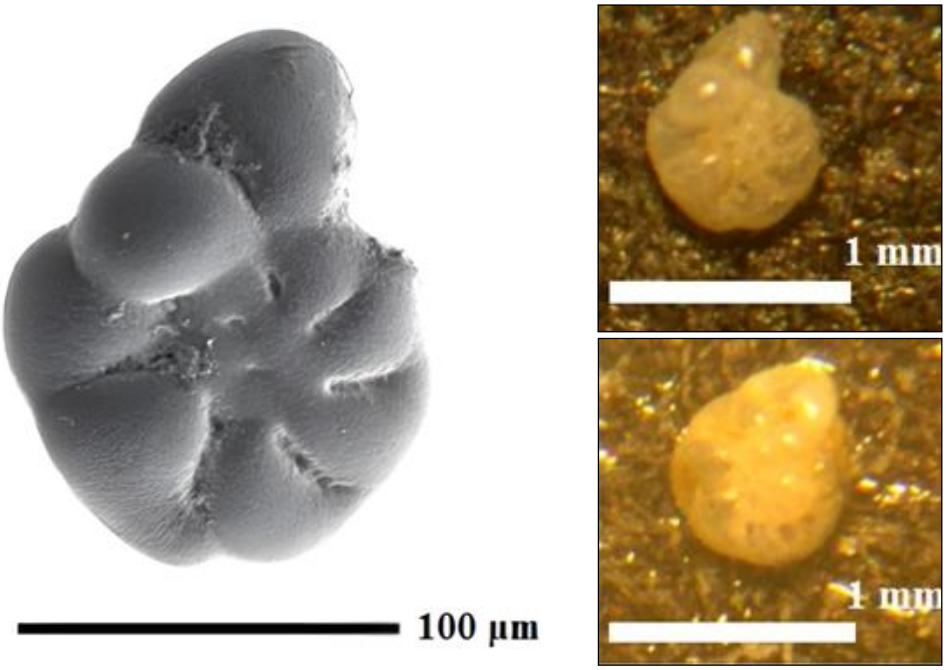

Fig.2. The image on the left is a scanning electron micrograph (SEM), while the photograph on the right was taken using a stereomicroscope, where it has been identified Aubignyna perlucida in the study area,

4. Discussion

Aubignyna perlucida is a species of benthic foraminifera that has been significant in paleoenvironmental studies, particularly during the Holocene epoch. The studies indicates that Aubignyna perlucida thrived during specific intervals of the Holocene and Its presence and abundance in sedimentary records provide insights into past environmental conditions and changes in coastal ecosystems. That the species is often used as a bioindicator in studies of delta evolution and coastal lagoon environments. Its occurrence can signal shifts in sedimentary environments, particularly in response to hydrological changes and avulsions in river systems and it has been proven during major ecological transitions such as the Ficarolo avulsion in the Po River Delta, where this event marked a significant mouth shift, influencing local sedimentation patterns and biodiversity [17][19].

The Holocene epoch saw substantial climatic and sea-level changes that affected coastal ecosystems and Aubignyna perlucida has been reflected these dynamics, particularly in areas like the Paliouras coastal lagoon, where it was coexist with other foraminiferal species [20]. And in stratigraphic studies, the species has been identified across various sediment layers, indicating its long-term presence and adaptability to changing conditions during the Holocene[21][22].

The distribution of Aubignyna perlucida is indicative of shifts in sedimentation rates and river dynamics. As river flow regimes oscillated during the Holocene, the abundance of Aubignyna perlucida reflected these changes, marking transitions from marine to more brackish or freshwater environments. This was particularly evident in studies of sediment cores from areas like Lake Ismarida, where Aubignyna perlucida was part of a broader assemblage that indicated significant ecological transitions over time[21][23].

The fluctuations in the abundance of Aubignyna perlucida was correlate with major climatic events throughout the Holocene, such as sea-level rise and shifts in freshwater input due to changing river dynamics. These events influenced not only the foraminiferal assemblages but also the overall

structure and function of coastal ecosystems, leading to changes in biodiversity and habitat availability[22].

Aubignyna perlucida is flourish in environments with significant freshwater input, particularly in coastal lagoons and deltaic settings where river discharge influenced salinity levels. Which marked a major shift in sedimentation patterns and increased fluvial influence[24].

This explains the presence of Aubignyna perlucida in the study area in large numbers, exceeding the rest of the existing species like ; Ammonia beccarii (Linnaeus, 1758), Ammonia tepida (Cushman ,1926), Elphidium incertum (Williamson, 1858) and Elphidium poeyanum (d'Orbigny, 1839).That It thrives in environments with large inputs of fresh water[24]. Since the influence of the river was present in the study area during the late Holocene, as showed the study [9][10], this has contributed to its abundance.

But the aberrant chamber shape observed in Aubignyna as shown in Figure 2, index as indicators of environmental changes of marine[25][26], this indicates that the marine influence continues to affect the characteristics of river water within the study region then. This reinforces the evidence that southern Iraq was affected by sea level fluctuations during the late Holocene[15][16][27].

This study supports previous studies in that the study area was affected by the fluctuations that occurred in the Holocene, specially the marine transgression in the late Holocene epoch that occurred at that time.This was aided by the appearance of the species Aubignyna perlucida, which is recorded for the first time in southern Iraq, where the marsh deposits are located. The environmental significance of this species has contributed to revealing paleoenvironmental changes in the study area.

5. Conclusion

- Four sediment textures were identified within the study area: mud, clay, sandy silt, and sandy mud, with mud being the predominant type.
- The micropaleontological analysis focused on the dominant species in the area, Aubignyna perlucida.
- The first recorded sighting of Aubignyna perlucida occurred in southern Iraq during the Late Holocene epoch.
- The environmental evidence indicating the species presence Aubignyna perlucida suggests that the study area has been affected by marine conditions, particularly marine transgression during the late Holocene epoch.

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أول تسجيل لنوع Aubignyna perlucida في رواسب أهوار البصرة / جنوب العراق

بشرى مجيد عيسى

قسم علم الارض، كلية العلوم، جامعة البصرة، البصرة، العراق

معلومات البحث

الاستلام	20 تشرين الاول 2024
الاستلام	30 تشرين الثاني 2024
القبول	14 كانون الأول 2024
النشر	31 كانون الأول 2024

الكلمات المفتاحية

Aubignyna perlucida ، اهوار العراق ، الهولوسين المتأخر ، وادي الرافدين ، جنوب العراق، المنخربات القاعية.

الملخص

ركز البحث على تسجيل ظهور نوع من المنخربات تم توثيق تواجده حديثا لاول مرة في العراق وخاصة في المنطقة الجنوبية وذلك من خلال جمع خمسة عشر عينة من سبعة مواقع ضمن محافظة البصرة الواقعة شمال غرب قضاء الشافي حيث تم تحليل انواع الرواسب لهذه العينات الى جانب تحديد انواع المنخربات الاخرى ووفرتها النسبية في المنطقة. وقد اظهر تحليل حجم حبيبات الرواسب وجود اربعة انواع من الرواسب وهي الوحل والطين والغرين الرملي والوحل الرملي وكان الطين هو النوع السائد في المنطقة وقد تم تحديد نوع المنخربات وهو Aubignyna perlucida وهو من المنخربات القاعية التي تعيش في البيئات المالحة إلى البحرية. ويعتبر وجوده في منطقة الدراسة دليلا بيئيا مهما على التأثير البحري في جنوب العراق وخاصة ضمن الرواسب التي يعود تاريخها الى فترة الهولوسين المتأخر.

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