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Vertebrate Fossils in Fatha, Injana and Mukdadiya Formations in Iraq

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Abstract

This study showed that the rock bed units of Fatha (M. Miocene) includes mold of fish fossils imprint on marly limestone; Injana (L. Miocene) includes large femur bone of *Mastodont* and large number of bone remains; and review study of Mukdadiya Formations (Pliocene) showed more than 21 mamalian species such as: *Mastodont*, *Hipparion*, *Gazzella*, Felidae, Bovidae, Antilopini, Caprinae, Crocodilia, and others. Those vertebrate fossils bones were deposited and preserved within rock bed units of fluvial and evaporite marine environments. Paleoenvironment of fluvial ecosystem made up of food chain, which were includes producer, herbivores as a primary consumer as *Mastodon*, *Hipparion* and *Gazelle*, carnivores as a secondary consumer as felidea and crocodilia and omnivores as aves; and restricted marine ecosystem were includes producer, minute foraminifera and primary or secondary consumer as fish.

Keywords: geology, vertebrate, fossils, bones, ecosystem, Iraq.

مواقع متحجرات فقريات في تكاوين الفتحة وانجانة والمقدادية في العراق

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الخلاصة

بينت دراسة بعض مكاشف طبقات الصخور، الى وجود متحجرات فقريات: فتكوين الفتحة (مايوسين متوسط) يضم قالب سمكة مطبوع على صخور مارلي لايمستون؛ وتكوين انجانة (مايوسين متاخر) يضم عظم فخذ كبير يعود الى جنس الماستودون وعدد كبير من بقايا عظام؛ وتكوين المقدادية (بلايوسين) يضم أكثر من ٢١ نوع من اللبائن مثل الماستودون و الحصان، والغزلان، والسنوريات، والبقرات، والماعز، والثعابين، والتماسيح، والسلاحف، والطيور، وغيرها. ترسبت عظام الفقريات وحفظت ضمن طبقات صخور مترسبة في بيئة نهرية اوفي بيئة بحرية تبخرية. والسلسلة الغذائية للنظام النهري الذي عاشت فيه متكون من المنتج (النباتات)، و حيوانات عشبية التغذية او المستهلك الاول مثل: الماستودون، والحصان، والغزال، والابقار وغيرها؛ و حيوانات لحمية التغذية او المستهلك الثاني مثل: السنوريات والتماسيح وغيرها؛ وحيوانات عشبية ولحمية التغذية مثل: الطيور، وغيرها. والسلسلة الغذائية في النظام البيئي للبحر المغلق متكون من المنتج مثل: المنخربات الصغيرة، والمستهلك الاول او الثاني مثل الاسماك، وغيرها.

Introduction

Many vertebrate fossil sites had been studied, such as: site of Jabal Zaltan, Libya which was contains diverse fossils of mammalian assemblage [1- 5]; site of most comprehensive record of mammals at Libya of Late Miocene- Early Pliocene site [6, 7]; South Africa sites has yielded a rich

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collection of invertebrates and vertebrates species of Late Miocene- Early Pliocene [8, 9], which was included new species of proboscidea [10]; fossil site at France which was well known for its mammalian fauna [11] ; site of mammals at Akkasdagi, Turkey, Late Miocene [12]; and many mammalian fossil teeth and bone fragments have been recovered from two caves at Malaysia [13]. Some geologic studies in Iraq referred to some sites include vertebrate fossils [15- 17]. Vertebrate fossils study in Iraq depended on field surveys, documents of Natural History Museums, and the published and unpublished data. The aim of this study is to review and discuss and collected these observations, to tabulate and locate it on the map of Iraq.

Geologic setting

Vertebrate fossil specimens of current study occurred within rock units in, Fatha, Injana, Mukdadiya Formations.

Fatha Formation (Middle Miocene): the type locality of the formation is at the south western flank of Jabal Makhul:

Lat.: 35° 10' 00" N.

Long. : 43° 21' 15" E.

Its comprises of greenish gray and reddish brown marly limestone, marl, gypsum and anhydrite. These rock units deposited at restricted evaporate marine basin which has been often separated from the open sea by rising ridges [18]. Its thickness is 445 meters. The underlying unit usually Jeribe Limestone Formation apparently conformably and overlining unit Injana Formation with gradational and conformable contact [18, 19].

Injana Formation (Late Miocene): the type locality of the formation is on the north east flank of southern Hemrin fold at Injana area on the main road of Baghdad- Kirkuk. Its thickness is 620 meters at type locality and may be reaching to 2000 meters at other sections. Its comprises marl, claystone, siltstone and sandstone enriched by carbonate materials [16, 18, 19]. Lower part of the formation was deposited at transitional environment (marine- continental) [20], and the upper part at the fluvial continental environment [21]. The underlying unit is Fatha Formation and the overlining unit is Mukdadiya Formation [18, 19].

Mukdadiya Formation (Pliocene): the type locality of the formation is on the north east flank of southern Hemrin fold, on the main road of Mukdadiya- Sa'adiya:

Lat.: 34° 02' 10" N

Long.: 45° 01' 50" E.

Its thickness reach to about 1411 meters, comprises interbedded bebbly sandstone, siltstone and mudstone [18]. Fining upward cycles of the formation refers to fluvial environment of deposition [19]. Rock bed units of this formation cropping out near foothill north and north east Iraq. The overlining unit is Bai Hassan Formation.

Methodology

Current study depended on the field surveys of the authors to the some vertebrate fossils sites. Some samples gifted for Iraqi Natural History Museum from worker men of building stone quarry near Makhmour sector, Erbil Governorate; and from fisher men of Razaza Lake about 50 km west Sammarraa City. And large number has been collected by Thomas et al., 1981, when they get permission and support from Iraqi GEOSURV. In addition to reviews of many previous studies. Large bone photo sent to Sanders from USA, Valli from France and Gafar from Egypt for Classification.

Results and Discussion

Vertebrate fossils studies depend on geology of the area in which occurred, its sites, environment of deposition, and ecosystem.

1. Vertebrate fossil sites: the vertebrate fossil sites in Iraq have been determined during field surveys by the authors, documents of Iraqi Natural History Museum, in addition to many previous published and non published data Figure- 1.

During field surveys on the hills, more than 15 meters near Tharthar Lake, about 50 km west Sammarraa city Figure- 1, which composed of clastic sediments deposited from fining upward cycles of meandering fluvial system sequence of Inana Formation (Late Miocene), large vertebrate fossil bone (Long: 40 and Width: 22 cm) (plate- 1, a) has been gifted from fisher men near Tharthar Lake to

the Natural History Museum. Sedimentological descriptions on rock bed units show that many bone remains was presence on the scoured surface within Sp facies, coarse sandstone beside pebbles and mud balls. Large bone photos sent to some specialist: William J. Sanders from University of Michigan, USA, Andrea M. Vali from Vector Higo Research Centre, France and Afifi, H. A. Gafar from Geologic Museum, Egypt for identification, in which they referred to femur of proboscidea order, mastodont genus [22]. Many fragments of bone remains have been presence within Pebbly sandstone rock units of Mukdadiya Formation near Mukdadiya- Saadiya road and near Sadour dam north east Baghdad city.

Documents of Natural History Museum show fish mold plate-1, b, about 25.5×12.7×7.5 cm, have been imprinted on marly limestone and extracted from quarry of building stone near Makhmour town, about 50 km west of Erbil City, in addition to vertebrate fossils near Habaniya about 50 km west Baghdad city and tusk of prehistoric animal (lost).

Previous study led to vertebrate fossils and fragments of bone remains were presence within Injana Formation (Late Miocene) and Mukdadiyah Formation [14- 17], Table- 1.

2.Environment of deposition: according to the environment of deposition of the rock bed units of Injana Formation (Late Miocene) and Mukdadiya Formation (Pliocene), the vertebrate fossils were deposited and preserved within fining upward cycles which were produced from fluvial environment [21]. Field surveys shows that the vertebrate fossils bone had been deposited with coarse grain sandstone contains pebbles and mudballs within bed loads on the channel floor as a Sp, facies, trough cross- bedded sandstone and Sp facies, planner cross- bedded sandstone. Mentioned environment includes many subenvironments: channel, natural levee and flood plain which provides water and sediments (soil) to support vegetation grows. Rock bed units of Fatha Formation deposited from restricted evaporate marine basin [18].

Table 1 - Vertebrate fossil sites in Iraq according to field surveys of the authors, documents of Natural History Museum, and reviews of previous data.

Authors	Formation	Age	Vertebrate fossils	Regions
Current study	Mukdadiya	Pliocene	Bone remains	East of Mukdadiya-Saadiya road, N.E. Baghdad.
Current study	Mukdadiya	Pliocene	Bone remains	Near Sadour dam, N.E. Baghdad.
Iraqi Nat. Hist. Mus. Documents.	-	-	Tusk of prehistoric animal	About 60 km south Mosul.
Piveteau, 1935	Mukdadiya	Pliocene	First remains of Neogene vertebrate in Iraq: <i>Mastodont</i> , <i>Hipparion</i> , <i>Gazzella</i> , <i>Oioceros rothi</i>	N.E. slope of Toug and Kormor anticline.
Al- Naqib, 1959	Mukdadiya	Pliocene	Vertebrate remains	-
Bellen <i>et al.</i> , 1959	Mukdadiya	Pliocene	Vertebrate remains	-
Thomas <i>et al.</i> , 1981	Mukdadiya	Pliocene	21 species of vertebrate fossils: carnivore felidae, <i>Mastodon</i> , Perissodactyla, bovidae antilopini, caprinae, crocodalia, aves.	Injana region , Southern Hemrin
Iraqi Nat. Hist. Mus. Documents.	Injana	Late Miocene	Vertebrate Fossils	Habaniya Lake, about 100 km west Baghdad.
Current study	Injana	Late Miocene	Bone fossil of Proboscidea	About 50 km west Samara
Iraqi Nat. Hist. Mus. Documents.	Fatha	Middle Miocene	Fish Fossil	Makhmour, about 50 km west Erbil.

3. Ecosystem: all ecosystems are made up of food chains that begin with energy produces by plants. Plants provide nutrition and energy when they are eaten by animals. Thus, energy is passed along, and the rout it takes from one organism to another defines a food chain. Each food chain is organized into different levels. The levels defined by the energy transfer from the environment to an organism and then from that organism to another [23].

The fluvial environment of Injana Formation (L. Miocene) and Mukdadiya Formation (Pliocene) provides water and soil (sediment: sand, silt and clay) which supports plants to grow near the fluvial subenvironments: channel, natural levee and flood plain. Such plants are the producers of organic energy. The producer level followed by herbivores (primary consumer) makes up the second level which were include *mastodon*, *hipparion*, *gazelle* and *bovidae*. Then followed by carnivores (secondary consumer) such as felidae and crocodlia. As well as omnivores (plants and meat eaters) make up forth level which were includes aves Table- 1.

In the sea, the main producers are phytoplanktones, tiny floating plants. The producer level is followed by a series of consumers. Carbonate rocks of Fatha Formation, deposited from restricted marine basin, are contains minute foraminifera mainly milliolids, ostracods, ostrea and other [18]. Mentioned fossils may be making up the first level (producers) and second level (primary consumer) of the food chain. Fish fossil of Makhmour, during her life, may be making up primary and/ or secondary consumer.

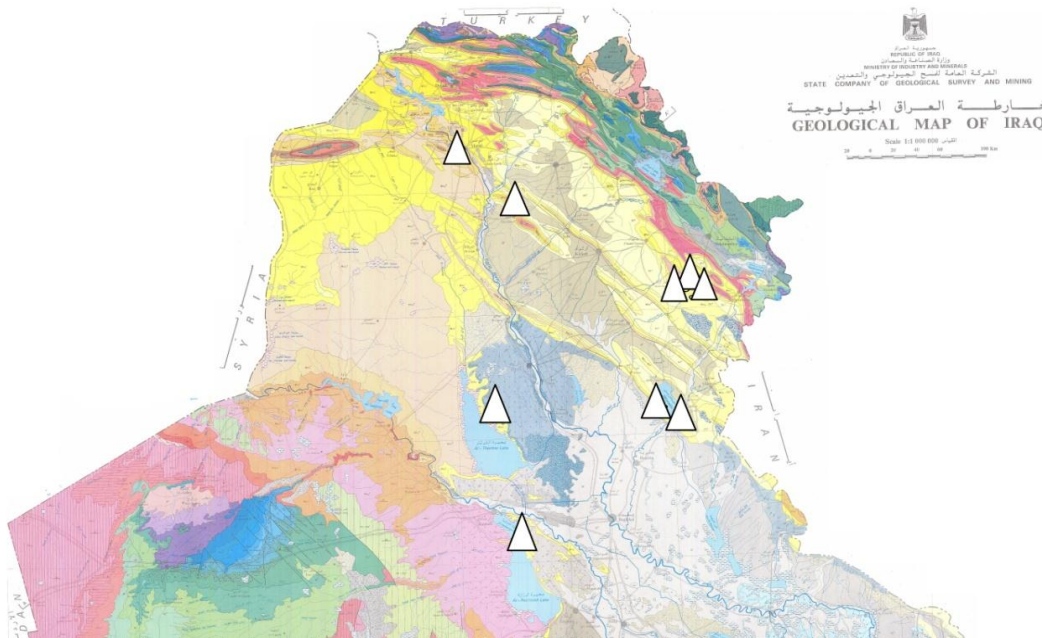


Figure 1- Location map of some sites of vertebrate fossils in Iraq

Plate- 1



Thickness (Meter)	Lithology	Facies Sequence								Facies	Interpretation
		LM	C	M	v.f.s	f.s	m.s	c.s	v.c.s		
5	Recent										Quaternary
1.5	C-B Sandstone									Sp	Lateral accretion (Point bar)
	Gravel									Se	Channel lag deposits
4	Claystone									Fc	Back swamp or flood plain deposit
0.3	L. Mud									C	Oxbow-back swamp deposit (Arid condition)
1.2	C-B Sandstone									Se	Lateral accretion
	Gravel										channel lag deposits
1.9	Claystone									Fc	Scoured erosion surface Back swamp or flood plain deposits
0.9	Mud									Fs	Over bank-upper part of point bar (Levee deposits)
1.7	C-B Sandstone									Sp	Lateral accretion (Point bar) Middle part

Figure 2 - Graphical log of Injana Formation (Late Miocene) near Tharthar Lake, Central Iraq, showed *Facies Se*, channel lag deposits which contains vertebrate fossil bones, coarse sandstone, pebble and mud balls (Al- Zubaidi, under preparation).

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