# Microfacies and age determination of the sedimentary sequences within Walash volcano-sedimentary Group, Mawat Complex, northeast Iraq.

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## Abstract:

The sedimentary rocks that existed within Walash volcano-sedimentary Group were studied in three areas: Mawat, Kanaro and Dashti -Khan sections.The sedimentological and paleontological studies enable the authers to recognized four sedimentary facies; two of them (W1, W2 microfacies contain planktonic foraminiferal) indicated deep marine environment extended from outer self to bathyal, the third (W3 microfacies) is benthonic microfacies indicating lagoonal depositional environment, while the fourth (W4) which is conglomerate lithofacies affiliated to shallow marine environment.These sedimentary facies assigned deepening upward depositional environments, this phenomena detected that the depositional arc basin was subducted and their shelf mobils downward with decreasing of sediment influxes during the convergence of the arc land with the Iranian plate.The foraminiferal species existed within the carbonate rocks of Walash Group assigned to Lutetian stage (Middle Eocene) with ranging 42.5-48 MY.

## Introduction

The Walash volcano-sedimentary Group occurs as allocthonous segaments associated with the sedimentary group of Naopurdan. The Walash Group occupies part of the Zagros thrust zone northeast Iraq.This present paper describes the microfacies and determined the age of the carbonate sedimentary sequence that appear within Walash volcano- sedimentary Group in three section lies on Mawat, Kanaro and Dashti -Khan areas (Figure-1).

The Walash (volcanic) Group was first described under the name of Walash volcanic Series by Bolten (1958), their type locality lies on Walash village in the Rawanduz river valley northeastern Iraq. The Walash group in its type locality composed mainly of volcanic rocks, according to Bolton (1958) it is formed a volcanic core passing laterally into sedimentary rocks. The eugeosynclinal realm which is situated along the Iranian and Turkish borders was divided into three different belts: the inner belt that of the depositional area of Qandil Series, was relatively shallow less subsiding and characterized by calcareous sedimentation without surly proved igneous activity (Jassim and Goff, 2006). According to Stocklin (1968) a stronger subsidence (in Iran) had been confined there to local troughs only. The center belt was dominated by strong volcanicity, the Walash facies dominates that strongly subsiding belt. The third outer most belt is that of Naopourdan group, it is mostly flysh like sedimentation with occasional volcanoes and relatively rare limestone (Buday, 1980).The Mawat Mountain composed of nappes piles, thrusted toward the west- south west on the sediments of the Arabian continental margin. Walash Naopurdan nappe is comprised of flysh sediments volcanic and fore arc- back arc sediments (Aswad, 1999).The studied area has been under convergent plate tectonics since Maastrichtian age, based on contemporary plate tectonic, there are evident relationships between convergent plate and arc magmatism (Mc Greay et al., 1985). The oceanic – oceanic convergent give rise to volcanic activity above the subducted slab and island arc is formed their (Montgomery, 1997). This tectonic relationship prevailed through the study of volcano-sedimentary formation of Walash group and other ophiolite in north westren Iran (khoy Complex) (Pessagno et al, 2005) . The culminating magmatic episode of studied volcanoes was of limited duration (Paleocene – Oligocene) (Buday, 1980; Aswad, 1999) and according to ( Koyi, 2006) the radioactive determination age of the igneous rock within the studied section reach to 43.1$\pm$ 0.3 M.Y.

According to primary study of Bolton (1958) and Stevenson (1957), the reconstruction of the lithologic section of Walash Group given by Buday

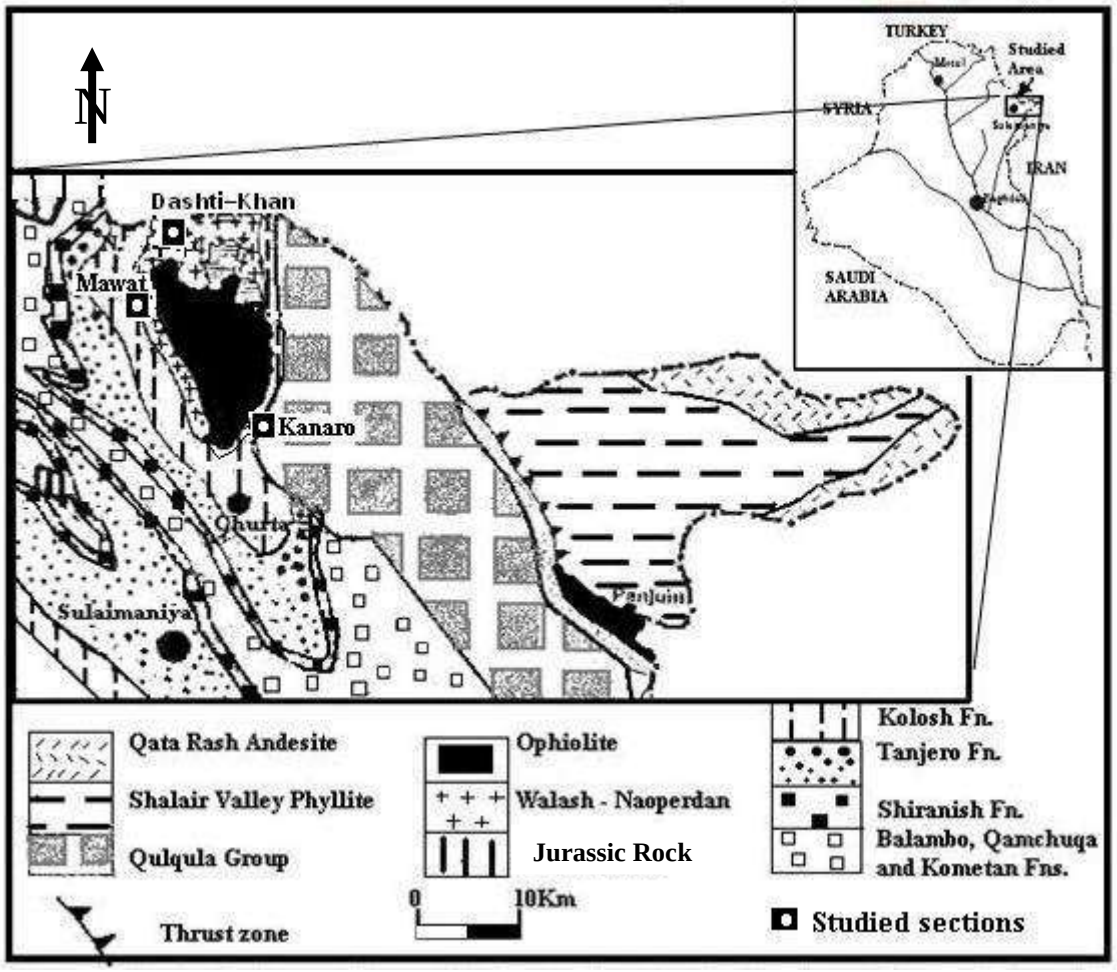



**Figure -1: Geological map of the studied area , showing the location of the studied section. Modified from Jassim and Al-Hassan (1977).**

(1980), he subdivided it into five part in which the carbonate sedimentary rock lies generally in the middle of the section and according to Jasim and Goff (2006 P. 208)it correlated with unit (d). The earlier geological interpretations of the Mawat modified to fit the proposal paleotectonic model, accordingly Aswad (1999) fined five main assemblages in the rock succession of Mawat area ; it is from top to bottom :

1- Ophiolite nappe of Albian – Cenomenian age.
2- Walash – Naopurdam nappe.
3- Tertiary – Sedimentary covers.
4- Neo- autocthon of Late Campanian-aastrichtian age.
5- Parautochthon of Albian – Cenomenian age.

**Microfacies**

Microfacies distribution in the studied sections reflected the presence of four sedimentary facies; (Figure 2,3,4) These are:

**Planktonic foraminiferal lime mudstone microfacies: (W1)**

This microfacies consist of micrite matrix, the allochems represented by planktonic foraminifera with less than 10% percentage of total microfacies contain( plate -1), these forams of small size and probably affected by heat. Stylolites of conical shape (Bles and Feuga, 1985) was recognized in the microfacies as irregular horizontal lines of dark brown colour, veins parallel or cutting the stylolites filled with calcite cement are recognized.

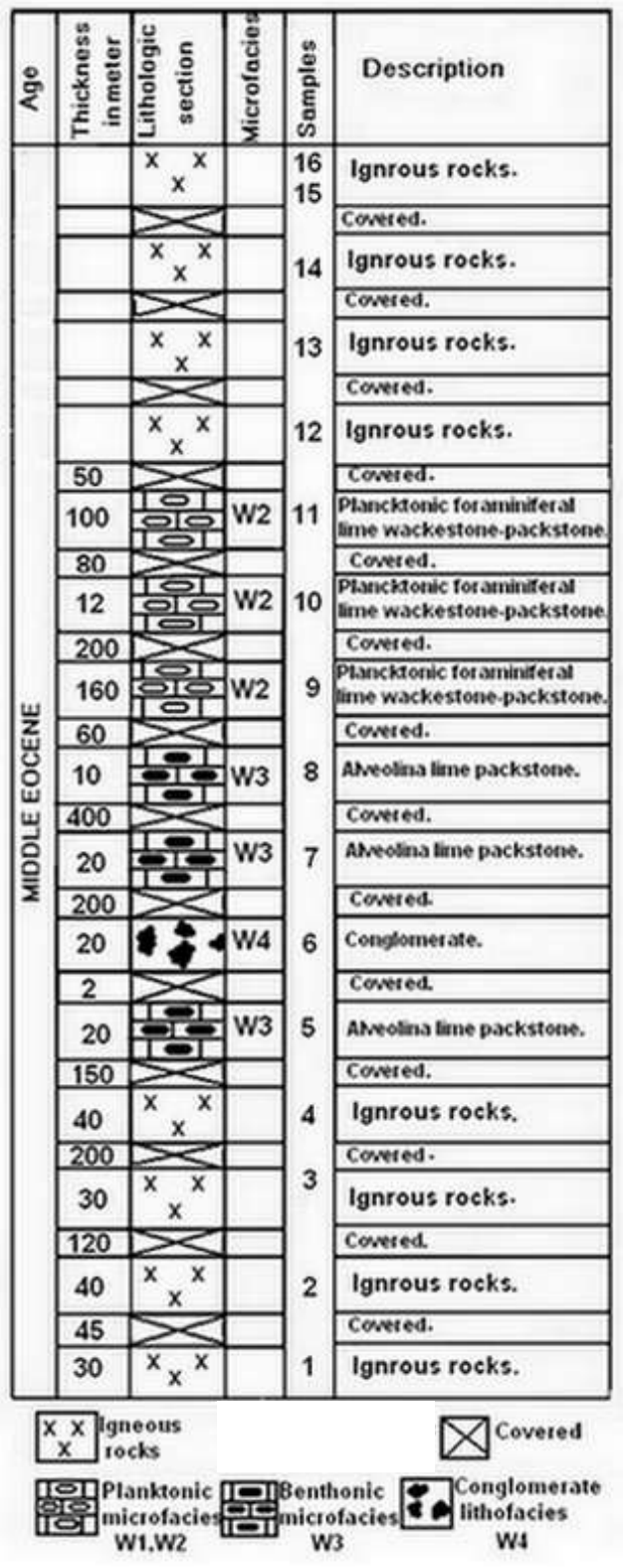



**Figure-2: Lithologic description of Mawat section.**

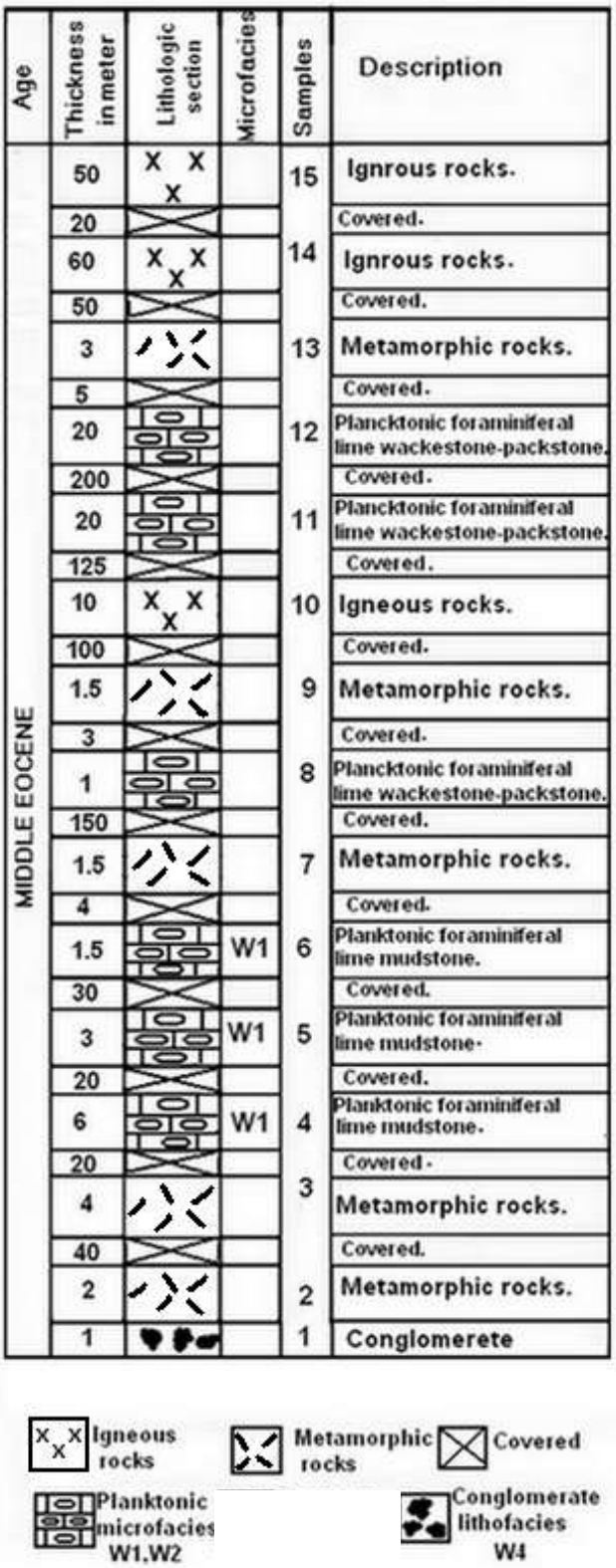



**Figure- 3: Lithologic description of Dashti-Khan section**

The forams were not well preserved but in spite of that the authors were able to recognized some genera like *Acaranina, Globigerina, and Globorotalia.* All the attributes indicated to outer shelf environment of the microfacies with depth ranging between 100-150 meter (Gibson, 1989), the microfacies can be correlated with SMF3 in FZ3 (Flugel, 1982).

**Planktonic foraminiferal lime wackestone-packstone microfacies: (W2)**

The microfacies embrace foraminiferal allochems, their percentage ranging between 40-70% of total microfacies content. Generally the planktonic foraminiferal are common (70-80% of the total allochems contain) and of normal size, they were good preserved in selective interval that indicates a warm arid condition.The planktonic foraminifera recognized in the microfacies belonging to *Acarinina broedermanni, Acarinina bullbrooki, Torborotalia cerroazulensis pomeroli, Torborotalia cerroazulensis frontosa, Globogerinatheka sp., Morozovella spinulosa and Morozovella crassate.*Bethonic foraminifera shows low distribution, their percentage reach to 20% of the total allochems content, this representation indicated the ability of these organisms to live in the sea floor having good oxygen and food. Gluaconite and opaque mineral of sand size grain found with the microfacies they arranged in laminated structure probably as a result of high directional pressure affected on the sediment. The matrix consists of micrite dark brown colour with conical styrolite. The sedimentological and biological attributes indicated middle – upper bathyal environment with depth ranging between 100-200 meter (Gibson, 1989). The microfacies correlated with SMF3 of FZ1 (Flugel,1982).

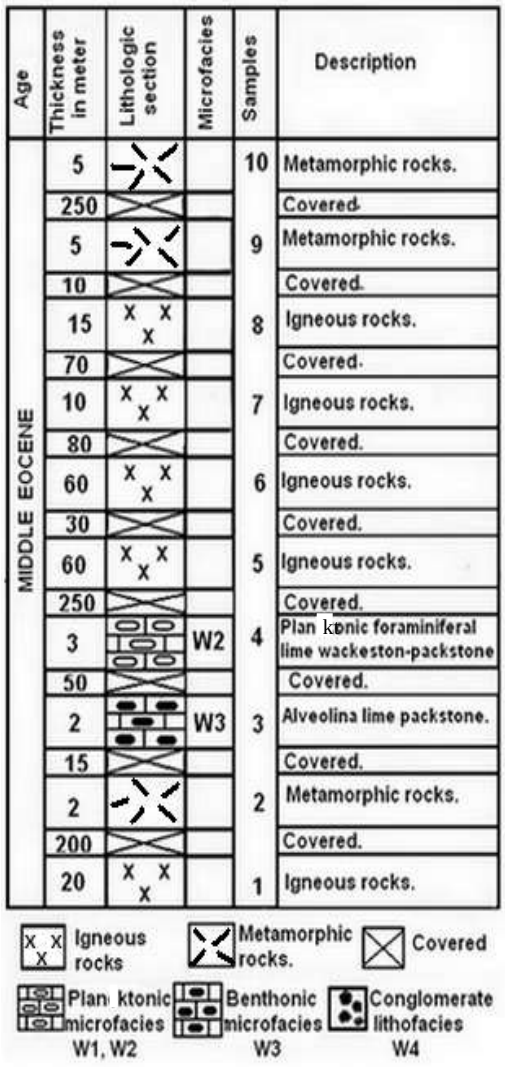



**Figure- 4: Lithologic description of Kanaro section**

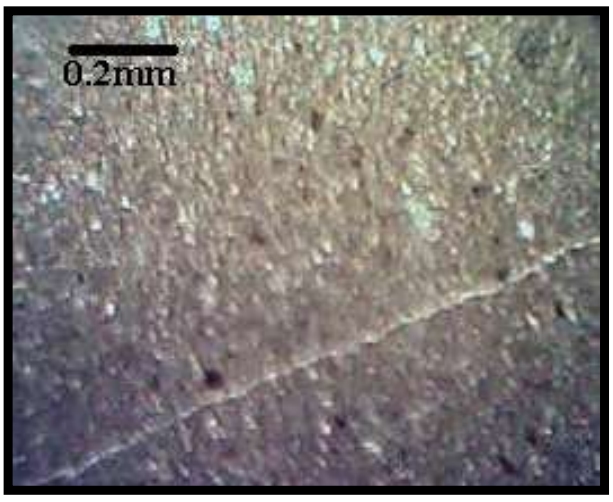
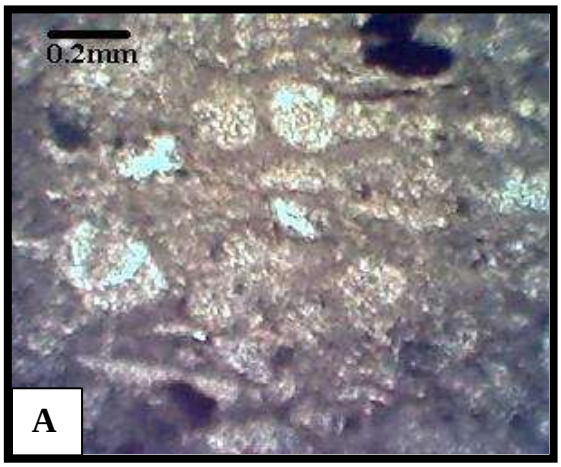



**Plate-1: Lime mudstone with rare planktonic foraminifera sample M5.**

**Alveolina lime packstone: (W3)**

This microfacies is characterised by benthonic foraminifera allochems with percentage ranging between 60 -70 % of total microfacies contain,



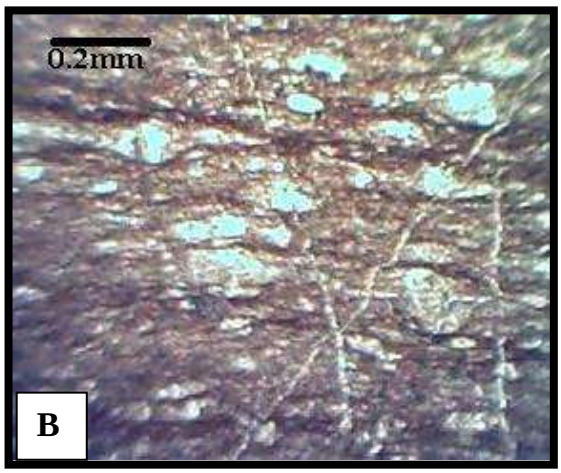



**Plate-2: (A) Planktonic foraminiferal wackestone- packstone Sample Mk9. (B) the same microfacies contains stylolite, sample M12.**

they are represented by *Alveolina muneri*, *Alveolina spp*. (plate-3,4), *Nummulites*, *Peneroples* and Rotalid in addition to pelecypod bioclasts with low appearance of Miliolid, *Discocyclina* (Plate-5,6). The forams in some interval are destroyed and affected by heat (plate-3). The matrix filled by micrite of dark brown colour. The microfacies was fractured that filled by calcite cement.The presence of Alveolina indicated shallow marine environment with depth less than 40 meter (Pautal, 1987), the rare occurrence of miliolid and the absent of evaporite minerals indicated simerestricted lagoon of inner shelf environment.


**Plate-3: Alveolina affected by diagenetic process, sample Mk8**.

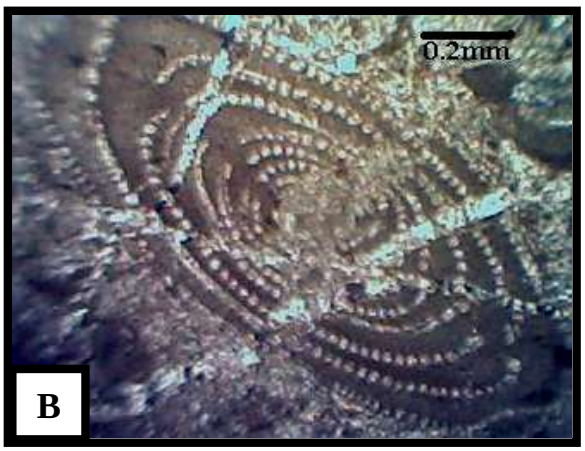



**Plate -4: *Alveolina* muneri ,sample Kw3**

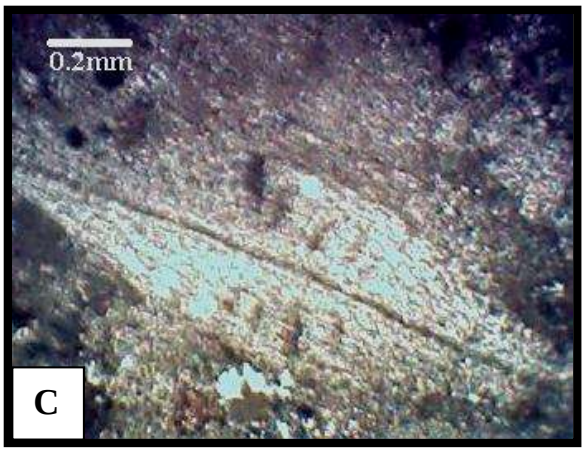



**Plate -5 *Dicocyclina sp.*, sample Mk8**.


**Plate -6: *Nummulite partschi*, sample Mk8**

**Conglomerate lithofacies: (W4)**

The facies embraces pebbles consist of igneous and metamorphic rock fragments of the underlaying rocks. They are subangular- subrounded shape. The matrix consists of sand and silt size grains of mineral. All these contents bounded by micrite cement. Veins filled by calcite cement was shown.

All the evidence indicated shallow marine depositional environment of the microfacies Walker and James, 1992).

**Tectonic setting and depositional environment:**

The tectonic setting of the Zagros thrust zone has been under convergent plate tectonisem since Maastrichtian age. The region was provoked by the obliquely moving of Arabian plate north east toward the active Iranian –Turkish plate. Later , the Arabian plate subducted underneath the Iranian plate. This movement resulting in intraoceanic subduction during Paleogene and producing an island arc Walash magma (Koyi, 2006).The Walash and Naopurdan groups in the thrust belt of NE Iraq are interpreted to have been formed as a calc – alkaline volcanic arc and in a fore-arc basin respectively. Their mutual position suggests that they formed above a NE dipping subduction zone in the closing Neo-tethys ocean. (Jassim and Goff, 2006) The sedimentary facies of the carbonate rocks within Walash Group are planktonic facies represented by microfacies (W1, W2), they reflected depositional environment extending from outer shelf to bathyal and benthonic facies embracing microfacies W3 that assign to simerestricted lagoon of inner shelf environment Conglomerate lithofacies W4 indicates shallow marine environment.The barrier that separated the two main environments probably a nummulite bank and it is not detected by sampling or the edge of the island arc acting as a barrier between the deep marine environment and lagoonal environment.

We believed that the sedimentary successions of Walash Group show deepening upward cycles. All the references assigned that there are no evidence of overturned during thrusting of The Mawat nappes piles. Mamat nappes were obducted and thrusted toward the west-south west on the sediments of the Arabian continental margin. This phenomena detected that the depositional arc basin was subducted and their shelf mobils down ward with decreasing of sediment influxes during the convergence of the arc land with the Iranian plate.

**Age determination:**

The studied carbonate rock sections of Walash Group yielded Planktonic foraminiferal assemblages, generally it is affected by digenesis which is reflecting their bad preservation. Accordingly, the biostatigraphic distribution study was difficult excepted in some interval five genera was recorded these are belonging to *Acaranina* (*A. broedermanni*, *A. bullbrooki*), *Morozovella* (*M. spiaulosa*, *M. crassate*), *Globigerinathika sp.*, *Torborotalia cerroazulensis pomeroli, Torborotalia cerroazulensis frontosa*. These species are dominates within biozones (P10-P11) of Lutetian stage (Middle Eocene). Benthonic foraminifera that are recognized within the shallow marine microfacies (W3) represented by *Nummulites partschi, Nummulites exilis*, *Alveolina muneri.* and *Discocyclina sp.* . These species are distribution within the benthonic biozones (SBZ 14). Which are assigned to Middle Eocene (Serra-Kiel et al. 1998). All the above biozones assigned to Lutetian stage (Middle Eocene) with absolute time ranging between 42.5 - 48 M.Y. (Gradstein,et al., 2004), this suggested age are coincided with older radioactive age that determined for the igneous rocks within the studied section, which is about 43.1± 0.3 M.Y. (Koyi, 2006).

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# السحنات الدقيقة وتحديد عمر التتابعات الرسوبية ضمن سلسلة والاش البركانية الرسوبية، لعنق ماوات، شمال شرق العراق.

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**الملخص:**

درست التتابعات الرسوبية المتواجدة ضمن مجموعة والاش في ثلاث مقاطع صخرية في مناطق ماوات وكنارو ودشتي خان الواقعة شمال شرق العراق. أثبتت الدراسات الرسوبية والاحاثية تواجد أربعة سحنات رسوبية: اثنان منها (W1, W2) تحتويان أنواعاً من الفورامنيفرا الطافية الدالة على بيئات بحرية عميقة والتي تمتد من بيئة الرصيف الخارجي إلى بيئة الباثيال، أما السحنة الثالثة فهي تحتوي على الفورامنيفيرا القاعية والدالة على بيئة البحيرة الشاطئية المغلقة، أما السحنة الرابعة فهي السحنة الصخارية للمدملكات حيث تدل على البيئة البحرية الضحلة.تشير السحنات الرسوبية الى وجود تعمق نحو الاعلى في قاع الحوض مع حركة الرصيف البحري نحو الاسفل يرافقه نقصان في المواد الرسوبية المجهزة للحوض الرسوبي اثناء فترة انغلاق محيط التيثس. يشير وجود انواع من الفورامنيفرا في الصخور الجيرية ضمن مجموعة والاش إلى عمر الايوسين الأوسط والذي يتراوح بين ٤٢,٥– ٤٨ مليون سنة.