

**Morphodynamic of Lower Part of Upper  
Zab River in Northern Part of Iraq  
(study in fluvial geomorphology of Archaeological channels)**

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**Abstract**

The junction area of Upper Zab River with the Tigris River in Iraq , Considered as an Assyrian project known "**Al Ngoob historical Project** ", which is out of order now. These Project as known belonging to the King Ashurnasirpal II (884-849 BC) which developed later on by the king Assarhaddon (681- 669 BC) to supply the historical town **Kalhu** with water.

Numerical visits and remote sensing data give another details about above project and its historical channels. The known idea about these project said ;

**(Divided from Al-Ngoob Project two channels 18Km in length on right bank of Upper Zab River before 12Km from its junction with Tigris river. One of them move toward south , While second one toward northeast.)** (David Oates 1968, Agha & Al- Iraqi 1976, Sussa 1986, etc.). According to this two channels the tunnel regulator of this project will be located in mid of above channels as mentioned, due to that the tunnel regulator will be considered as the beginning of this project too.

To follow the direction of them ,as shown in maps affiliated to these research ; that indicate those channels move according to the direction of Upper Zab River , one of them following the direction of Al Zap River while the second one going in the different direction of it ; Scientifically that is not logical when any channel move in opposite direction of any river , as well as to contour lines. So the possibility of the second channel will be weak to irrigated Kalhu by such project From this side of the city. From latest above channel the idea of this study established. There is no doubt in that, Ashurnasirpal IInd supplied his capital with water from Upper Zab river as he was mention in his notation, but the doubt will be in that , when we will be affiliated his project to this location of the capital Kalhu. Certainly that mean he brought the water from another part or direction to this capital, as the indications which have been given in this research succeeded.

## Introduction

One of the most important reasons to missing the Archaeological channel of ancient civilization in Iraq in field is the morphodynamic actions of rivers, Specially when man were leaving it with out maintaining for long time. So the old Iraqi's where changing the surface of their lands by great project to get highest agriculture products, these products comes to its lower amount as soon as that civilization will be end due to natural and human reasons.

This study may be give an idea to those land which affected by morphodynamic actions between (35° 59 ' 20.18"-36° 05' 20.18" N) latitude and (43° 20' 29.15"- 43° 36' 05.55" E)

longitude in lower part of upper Zab river in Iraq. The morphodynamic of any river depending upon ; lithology, Topography, Geology, soil properties ,plant cover, Land use, load of river and discharge (M.Morisawa & and Vermori 1985) with considering to the time too.

This study amid to explain through geomorphological actions the purpose of the archaeology channel in studding area , which field remark it, remote sensing data's , and notation. that's mean to show the possibility of the idea which say that; the project of Ashurnasirpal IInd located on right side of lower part of Upper Zab river in Iraq only to supply water to Kalhu, and to show the ability of reuse its by the help of pumping methods in this days also.

A modern map extracted by Arial photographs (1989) to cover the historical channels on both sides of the Upper Zab River, not as known previously on right side only.

This research can contain three parts ; The surface water and natural resources, Uses of ancient man and finally recent geomorphological actions.

This study found uncovered historical dam near tell Abu-Sheta (206.4Meters) a.s.l with adding extra archaeological channels on left side of Upper Zab river within length of (23.78kilometres). Both of these dam and channels are not mentioned before.

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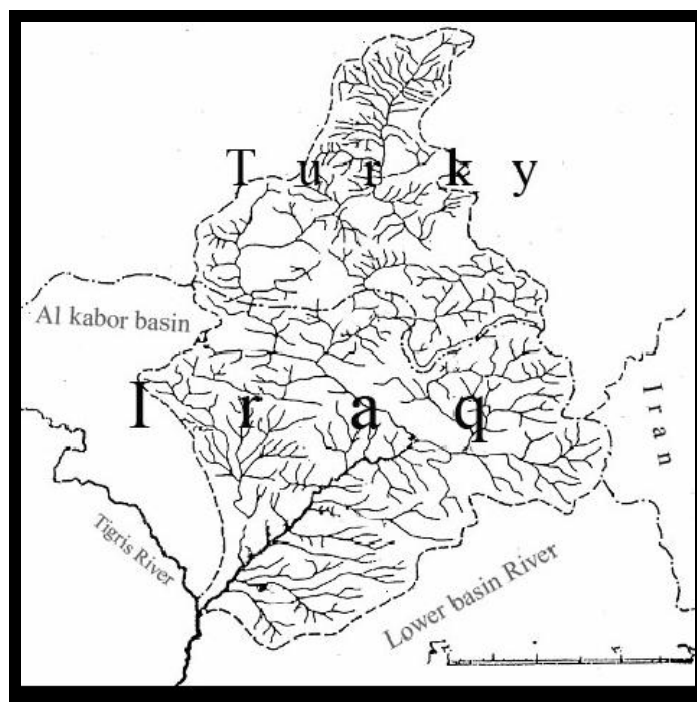
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### **surface water and natural resources in studing area**

The studied area near the junction of Upper Zab river with Tigris river, effected mainly by running water and load of river which comes from the areas which located above it. In ancient time these area has been used by man in full capacity by irrigation project , while now we using it partly.

The data of collected from two measurement stations that are Aski-Kalak and Al-Mangooba discharge stations , supply us with data of running water (discharge , load of river etc.)Which located on the Upper Zab River , upwards the our area , exactly near the junction area of the two tributaries of the Upper Zab river.These tributaries known, Al-Zab and Al- Khazzer which faraway upwards the Upper Zab River , about 10.62 Kilometres from studying area at location of  $36^{\circ} 09' 46.30''$  N  $-43^{\circ}32' 17.05E''$ . They joining of these tributaries with each other done the Upper or Great Zab River in Iraq. To flows drainage of these area from this location will be no important valley or tributary to add water to these stations till the beginning of the studding area , with some exception of very small valleys.

The Upper Zab River considering as one of the important tributaries of Tigris river ,this unique resource supply the study area with surface water , Its discharge estimated with 33% from total discharge of Tigris River, some years reach up to 52% as in the year of 1969. (General Directory of water storages and dams 1995),.The basin of Upper Zab River locate between  $36^{\circ}$ - $38^{\circ}$  N.This basin divided into upper part which determinates between  $44^{\circ} 00'$ -  $44^{\circ} 18'$  E Longitude , this part considered as the source of water, while its lower part between  $43^{\circ} 18'$   $-44^{\circ}00'$  E Longitude , which considered as the mouth of it as in Fig: 1 shown (Mohd. 1981).



After: Mohd. (1981), " The basin of upper Zab River in Iraq / Hydrological study " unpublished master dissertation, Art Faculty, Baghdad university, P.103

**Fig 1:THE CACHMENT AREA OF UPPER ZAB RIVER**

The basin area of Upper Zab River reach to (26473) Square Kilometres 62.7% of it in Iraq, 34.8% in Turkey and 2.5% in Iran. (Fat-tah and Marry Aziz 1970)

The high elevation in the source area of Upper Zab River lead to:- sudden flood , in Middle and lower parts of it. While Natural agents such as lithology ,topography and geology ,which can be effected by (climate, rainfall and temperature). All together can be affected the load of river and discharge , beside that (Plant

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,soil properties, land use with considering to the time and human activities) also (M. Morisawa 1985). Total of above agent use to determinate the morphodynamical action of this river in study area.

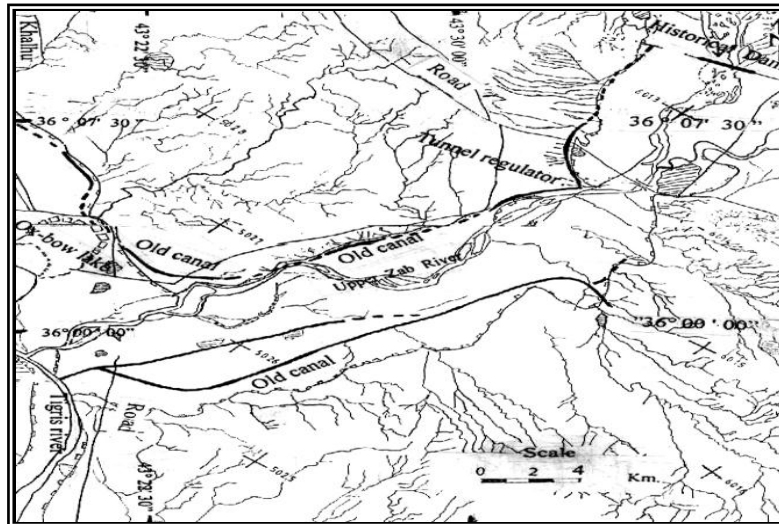
The layer of lower and upper fars formations locally named by Al-fatha and Injana formations are out cropped in the studied area ,which belonging to Miocene age with thickness of 238meters , the Muqdadia formations out cropped with thickness of 65meters sometimes reach to 680meters towards south east of studding area , the strata of Bihassan formations found in this area with thickness of 10-250meters. Above the Miocene and Pliocene the Quaternary formation will be laying down ,which is visible in flood plain deposits as four levels of Terraces, on surface fill valleys and slope deposits are found (General Directory of water storages and dams 1995)

To know the direction and amount of erosion of Upper Zab river, that needs to determinate the effecting of stratography by water flows. The penetrating of water can be determinate also by the type of the earth crust which effected by different compositions and facilities of rocks ,although we are considering the penetrate water to the inner of the earth as lost water, But it is one of the most important sources to supply the river by water in the areas when level of river water is equal to water surface or less than it.(Al-Sahaaf 1970)

The long extension of this river basin from north to south divided the climate to familiars two types as CS and BS (Mohd.1981). The mean of temperatures in mountain areas reach (16.5 – 19.5°C) as in the source of the river, while in hilly areas (20-22°C) and finally in plain areas (21.5 – 22.5°C) as in the mouth of the river.(General Directory of water storages and dams 1995).

The data depend upon the suggested Qwair dam in these area help to gave the real reading of Upper Zab River for more than 25 years, depending upon the location of mentioned two discharge stations above, to estimate the monthly and annual discharge , as consider these location as the beginning of these studied from the north, which is in same way the location of Assyrian dam found in this study which indicate by remote sensing data technique and field work. So that we can say that ; the Assyrian they have com to know the location of their irrigation projects as in Fig: 2 shown.

According to the location of these stations upward of this dam about 25Kilometres , that will be need to account the extra water coming from the area between these stations and this dam , which estimate by 3300 square kilometres ,when the estimation discharge is 13.706 cubic meter/ second in the beginning of study area in highest amount of flood. These amount when the flood happen in Al-Zab , Al- Khazzer tributaries and the extra area between this dam and above two discharge stations in same time.(General Directory of water storages and dams 1995)



Interpretation Arial photographs of Mosul ,Qaiarah, Shirqqat (1989) ,Directory of Military survey Iraq , scale 1/50000,

**Fig 2: showing the historical dam and channels in studying area**

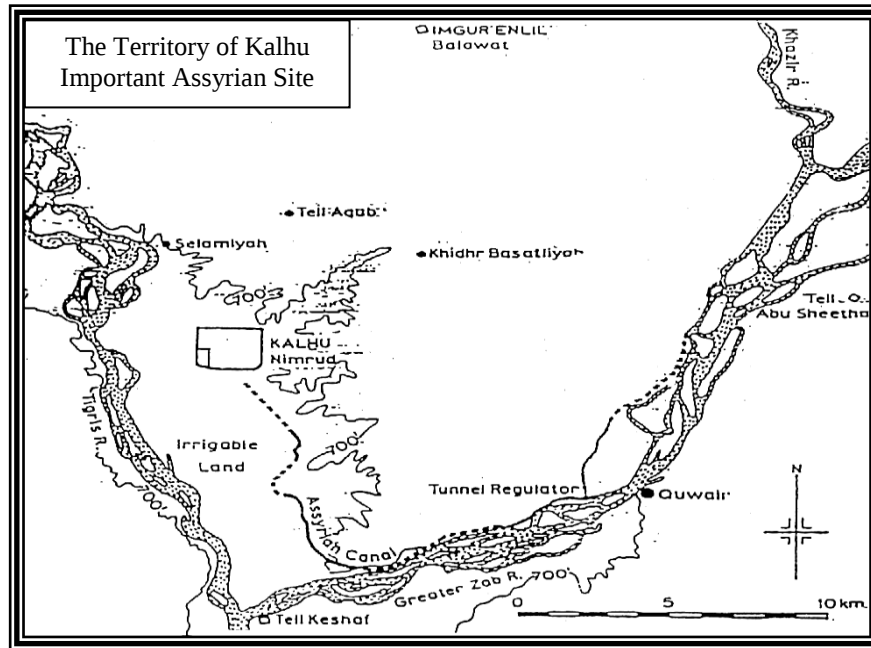
The amount of suspension load which coming in the beginning of studying area can be estimated by 7.69 Million ton /year , 6.7 Million ton /year from it coming through Zab River , 0.28 Million ton /year from Al-Khazzer River. While the base load sharing with 0.71 Million ton /year. (Mohd.1981).All above loads and discharge mentioned, can be planning for historical dam mentioned above.

## ANCIENT USES OF MAN IN STUDDING AREA

The above information's about quantities of discharge and the amount of load which comes from the Upper Zab River towards the study area might be give comparative studding in these area in Assyrian's and ancient time. The right bank of Lower Zab River ,

Showing now old trace of irrigation channels by the help of remote sensing data's and field work, which is very close to the land of the Al-Kalhu resent Al-Namroud (one of the fourth old capitals of Assyrian) (Fig.3). The discovered project in these area known as Al-Ngoob Project which located on right bank of Upper Zab River, this project affiliated by archaeologist to the King Ashurnasirpal IInd (884-849 BC), which is famous as Sannacherib project (705-681 BC), the idea of these projects to pull water from tributaries of Tigris River towards capitals of the Assyrian's, these tributaries almost located on higher levels than the Assyrian capitals. As inscriptions found, Sannacherib brought water to his capital Nineveh from Al- Komal and Al Kosaar Rivers. (Sussa 1986), while Ashurnasirpal IInd brought the water to his capital from Al Zab River, although these capitals were located on the Tigris River

The famous idea of Al-Ngoob Project is that ; this project consist a tunnel regulator to take the water from right side of Upper Zab River (12.29Kilometres) above the junction of Zab river with Tigris River to Kalhu. As fig.3 show, divided from this tunnel regulator two channels. The first channel take the water from the tunnel regulator towards Kalhu in direction parallel to Upper Zab River, then it will go towards north west to flood plain of Kalhu. From same tunnel regulator the second channel take the water toward north east upwards the Upper Zab River ,the total length of these above two channels reach about (18kilometres) , with width about (4meters).The first channel may be going in some limit according to elevations of this area, but the second one can not be possible to go in opposite direction of the Zab River or contours line.



David Oates (1968), "Studies in the ancient history of northern Iraq" Published by the Oxford University press, London, P.43

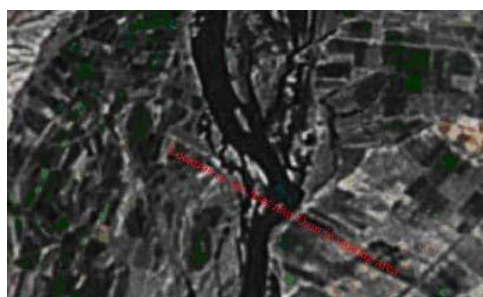
**Fig:3 showing the ancient irrigation channels on right bank of Upper Zab**

### **River as discovered**

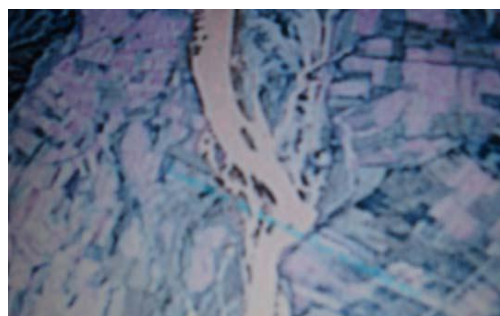
These channels developed by Assarhaddon later on (681-669 B.C.), When he done a regulator to it, as he mentioned that in his inscriptions (Sussa 1986).The previous archaeological studied indicate that; the water are not flows in these days in this project due to the accumulation of the large amount of sediment's according to that, these channels became above level of the water of Upper Zab River in this days (Agha & Iraqi 1976).But the reality

is not that, many visit to the study area and the measurements (AL-Naish & Sultan 2006) indicate that the Upper Zab river lower than this tunnel regulator with many meters in this days due to the erosion action according the following explanation " , The action of erosion can keep the river in lower point than its banks due to the weight and horizontal movement of water which lead to vertical cutting ".

#### RECENT GEOMORPHOLOGY IN STUDIED AREA



a. Image without enhancement



b. Image with enhancement

Google earth(2006), Image ©2006 digital globe.

**Fig: 4 Image showing the location of the Assyrian Dam in studying area**

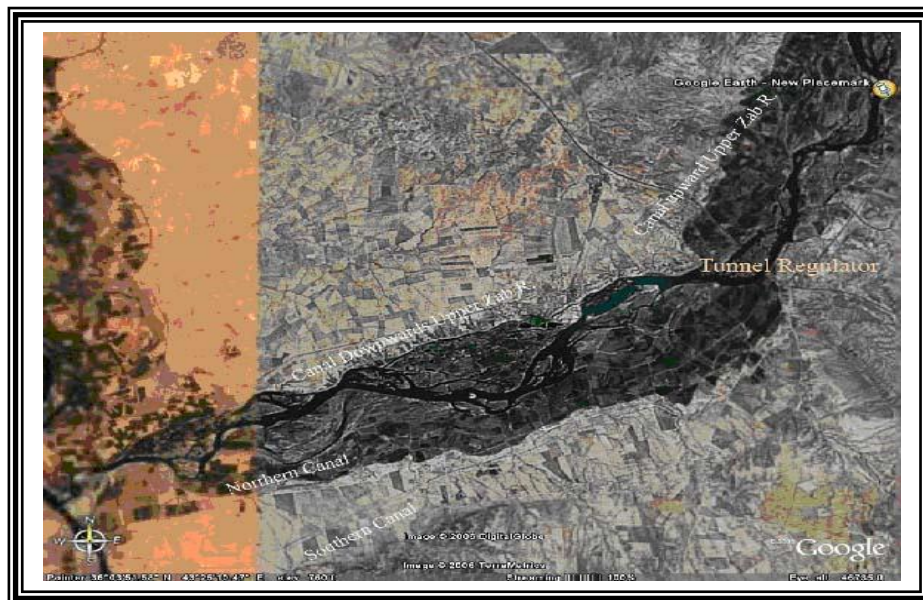
Starting from the ancient known archaeology channels in studied area ,the field work and the remote sensing indicate to unknown historical dam in the same place where the above suggestion dam given by (General Directory of water storages and dams) located ( $36^{\circ} 05' 1.99''\text{N} - 43^{\circ} 30' 54.67'' \text{E}$ ) at elevation of 206.4meters above sea level.(Fig: 4).With it's enhancement(ERDAS Imagine, USA).

As well as to the above dam this studied indicate by same above method of research to extra undiscovered channels located on the left bank of The Zab River , which can give another evident to this dam to irrigated both sides of river as our dams working these days, this dam and channels on both sides of river showing complete irrigational project was given in this area in that days. Due to that: this study will give vast descriptions of this channels , which starting on lift side near the mouth of the Upper Zab River exactly front of the above mentioned tunnel regulator on right side of the Zab River as in figure 2 shown.

Uncovered channels have been shown as road in many different maps as Nineveh Administrative map (Al Daggistani and Al Gawaddi 1999) as well as to the (Google earth) program as in Figs 5&6.shown , these channels might be will use as junction roads between the maim roads of Mosul Karkook road with that another metalled road near Al Kashsf Archaeological Hill. According to the needs and due to the flatness of the these historical irrigation channels too, most of it had been already changed to un metalled roods in this days.

The beginning of this channels far about (3Kilometres) on left bank of the resent Zab River in these area in elevation of

(205.1meters) above sea level to be visible for about (1.9Kilometres) then will disappear to be visible again in elevation of (204.3meters) above sea level with length 2.12Kilometres , that exactly near Zimmarah sambas village, these channel will turn  $90^\circ$  to make shape of buried tunnel regulator. As much as will go toward in the direction of the mouth of these channel that near the junction of the Zab River with Tigris River, this channels will be more visible. Near Al Sak-kia village, this channel will distributed to two branches, one of them move to make arch reach (14.58Kilometres)in length towards to the south of the northern channels which going south and then will be parallel to Lower part of Upper Zab River. While the Northern channel (7.08Kilometres) in length start near Zammarat sabber village towards Al Sak-kia village then to Al Soflah and Al Aulliah villages till it's mouth on Tigris River. The above two channels connected with each others near the road which coming from Sultan Abdullah and Tell Al sha-aer , Dwayzat Fookani, Dwayzat Tahtani, and Niah-Naaha villages as fig. 6 shown.



Google earth(2006), Image ©2006 digital globe.

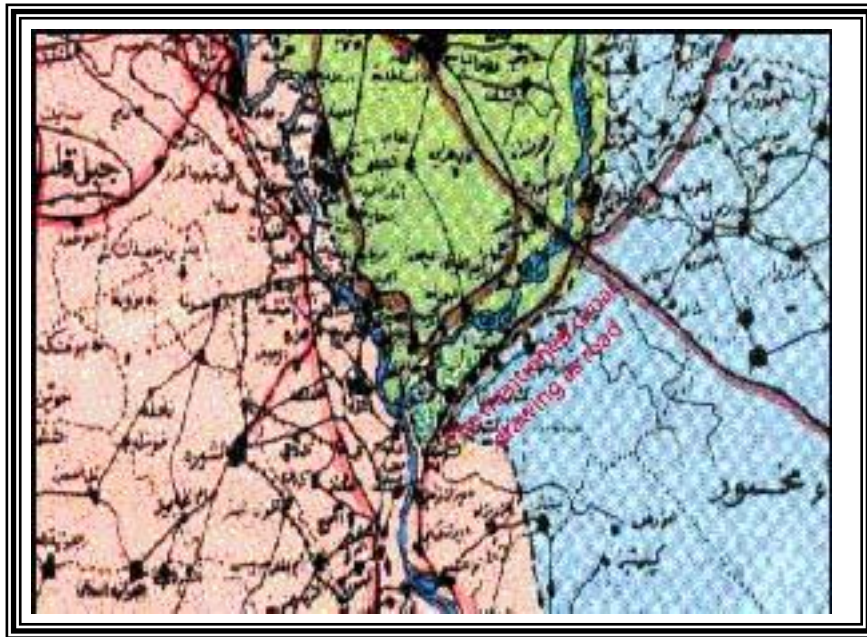
**Fig: 5 Image showing archaeological channels in the studying area**

The total length of visible channels in this locality (21.66Kilometres) from the total channels (23.78Kilometres). The end of this channels intercalated with the main Tigris River south of the junction of Upper Zab River with Tigris River with about (1.1Kilometres).

There were no exactly date of to the established of these Archaeological channels in studied area. The King Ashurnasirpal IIInd who mentioned his irrigation work in these area , so that the researcher will consider it as the age of the beginning of these channels that mean before 2890 years to determinate its age. Near the mentioned historical dam upwards of this studied area, the elevation of land reached (206.4Meters)a. s. l. ,these value will be the highest elevation according to this project. Definitely the elevation will reduces from the beginning of the channels on left bank of river from (193.8 Meters) a. s. l. downwards till will reach (187.2Meters) a. s. l. where it was pouring in Tigris River. The elevation of Tigris in this area about (180Meters) a. s. l. as(Figs 2and 5) shown that.

When their is no illegibility to measuring the erosion in studying area by (Bergsma 1983) method, as he was depending upon the length of valley meters / Area square kilometres (Morisawa and Vermori 1985), due to the interference of man, which had been visible to change the surface of the earth in these area. That mean this area is not a virgin as well as isn't located in source of river area where grooves of river is very deep as Bergsma

studied. Due to those reasons the researcher will flow the measurements of erosion through his measurement in fieldwork data and by the help of the new techniques of Google earth program, to count the erosion<sup>(\*)</sup> in this study when he determinate its age as mentioned above and the value of elevations as coming below.



After. (Al Daggistani and Al Gawaddi 1999)

**Fig: 6 Part of the Administrative map of Nineveh Governate in study area**

The vertical section of Upper Zab River and the Archaeological channels on both banks of river in these days, gave idea to the situation or amount of the erosion in these area, when to come to know that the Archaeological channels on right bank is higher than the river by (6.3meters) while on the of left bank by (6.6meters) when the elevation of the channel on right bank is

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<sup>\*</sup> This type of measurement can be in the areas were the age of it known only.

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(202.5Meters) a. s. l. and (202.8Meters) a. s. l. on left bank of the Upper Zab River , while the river it's self (196.2Meters) a. s. l. on same vertical section. According to above measurement of elevation we can say that; when the elevations of both channels are about similar on both bank of river from resent river , that mean they are belonging to the same time , when this channels were in same level with the Upper Zap River or less than it in that time.The different elevation of historical channels according to the resent river with estimation of project age as given above will give the amount of the erosion on both side of lower part of the Zab River , Although there were very high of deposition amount in these area according to the higher amount of sediment coming to these area by the flood as shown in this study, this study shown the erosion will dominating , the erosion of the right bank of river (0.217993centimetre / year)while the erosion on the left bank (0.8373centimetre / year) as this studding indicate.

The morphodynamic of running water usually affected on the irrigation channels or projects of Mesopotamian civilization and its appearance too, some of them buried or eroded by this action. When man changing the surface of the earth by his project or any other action, we can considering him as one of human geomorphological reason to change the earth surface, due to the above reason we can say that the Assyrian lands had been changed original morphodynamic of their lands In studied area. To leave any channel or irrigation project in front of natural resources actions and for long time of different generalization with out maintenance , definitely the power action of surface water will do back to its origin action as before construction those channels or project of irrigation as in studied area.



## Results and conclusion

This study found a historical dam near tell Abu sheeta , located on the end of the other side of discovered channel which going upwards of the Zap River From tunnel regulator of the known project 36° 04' 23.28 N- 43 36 05.55 E(206.4meters) above sea level (Not mention before).

The location of historical dam in studied area, it's the same location of dam suggested this days by General Directory of water storages and dams which known as Quwair suggested dam.This suggested dam considered as a full – irrigated project not for Kalihu only, but for the flood plain in study area.

This study found an irrigated historical channel on left bank of Upper Zab River(23.78Km. not mention before) also.

Those Archaeological channels and dam found in this studying , gave reason to reject the known location of Ashurnasirpal 2nd project to brought water to capital Kalihu because no channel can supply dam located on main river with water specially when locate above it. So the new idea will be **((the beginning of this channel should be near above dam, not near the tunnel regulator mentioned by archaeologist and the regulator due to above discussion will be for exiting the water towards the mouth of The Upper Zab River to across the recent river , when there were no channels mentioned running in these area, the another evident that seen for the regulator exiting the water, when to see the width of the inner side of resent regulator will be less step by step till the outer side of regulator on the Zab River , that's mean: to determinate the water**

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existing form this regulator as well as to see the erosion on the conglomerate which is the material of this regulator from the inner side of it not from the outer side)).

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### المستخلص

تعد منطقة التقاء نهر الزاب الأعلى مع نهر دجلة من المشايخ التاريخية في العراق، المتروكة والمهملة اليوم لأسباب متعددة. ينسب هذا المشروع كما هو معروف إلى الملك الآشوري آشور ناصر بال الثاني (٨٨٤-٨٤٩ ق. م) والذي قام بتوسيعه الملك الآشوري أيضا أسرحدون (٦٨١-٦٦٩ ق. م) تجهيز مدينة كالح الأثرية (المرود) حاليا بالماء.

الدراسة التطبيقية وبمساعدة الزيارات الميدانية المتكررة وبيانات الاستشعار عن بعد، أعطت تفاصيل أخرى عن المشروع أعلاه والذي تلخص فكرته بالاتي:

((يتفرع من ناظم النكوب قناتين طولهم ١٨ كيلومتر واقعتين على الضفة اليمنى من نهر الزاب الأعلى وبمسافة ١٢ كيلومتر نحو أعالي نهر الزاب الأعلى عند التقائه بنهر دجلة إحداها تتجه صوب الجنوب بينما الثانية صوب الشمال)). (ديفد أوتس ١٩٦٨ ، أغا والعراقي ١٩٧٦ ، سوسة ١٩٨٦ ، ... إلى أخ ) ، وعلية اعتبر ناظم المشروع بداية المشروع الذي يتوسط القناتين السابقتين أعلاه.

انطلاقا من القناة التي تتجه صوب الشمال الوارد ذكرها في أعلاه انبثقت هذه الدراسة، وتتابع سيرها مع نهر الزاب الأعلى كما في خرائط البحث فإنها سوف تسير باتجاه عكسي مع هذا النهر ، وهذا لا يجوز منطقيا وعلميا ، لان أي قناة لا يمكن لها أن تسير بالاتجاه العكسي لمجرى نهر تقع هي على حافته وباتجاه مغاير للانحدارات وخطوط المناسيب التي تمتلك قيم أعلى ، وعلية فان احتمالية مثل هذا المشروع سوف تكون ضعيفة لإرواء مدينة كالح من هذا الجانب ، وهذا لا يعني بأنه يتنافى مع النص الذي دونه الملك آشور ناصر بال الثاني والذي يقول ((بأنه جهز عاصمته بالماء من نهر الزاب الأعلى)) ، إذن من المؤكد انه جلب الماء إلى عاصمته من موقع آخر إذا ما صحت فرضية البحث الحالي.