

AGGREGATE and FILL SOURCE STUDY of WEST QURNA and ADJACENT AREA, SOUTHERN IRAQ

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Abstract

The area of west Qurna oil fields is a low topography and represent a part of the marshes dried. The top layer of soil is composed of cohesive fragile with compression is very low. The thickness of its is about 1m, rich in organic matter. This soil is not suitable to establishing pads for oil wells, up appropriately and establish a road network connecting these wells with each other and with the main roads in the region. The soil sections were tested visually. The coordinates and photographs of mentioned sections were took using GPS and digital camera respectively. Improved raw satellite image were used which captured by Landsat in April 5th , 2003 covering "path 166 raw 39" . ERDAS and ARC GIS, software version ninth were used to preparation the satellite image for serves the purpose of the study, produced the land cover land use digital map, and to locate the visited sites on this map. It has been confirmed that the **Onsite** of west Qurna area is empty from any source of aggregate, because the sections of the soil is:- From top to 12m deep is silt clay, marely clay and organic clay. From 12m to 17m is silt sand. From 17m to 20m is sand. Deeper than 20m is sand stone. The water table is about 6m. In the other hand the granular sand cover a very wide area of the southern part of study area (**Offsite**) which adjacent to west Qurna area. Another part covered with new sediments of the Gypcrete alluvial fan. The percentage of the sand increased as the gravels decrease from south- west to north-east. The gravels have different size, the smaller is granule, and the bigger like cobble as maximum. There are about 30 out crops utilized as aggregate quarries for construction. They are about 5-12 m deep. Their sediments are layer type. Sometimes, the sediments lens type are parallel or semi parallel, positioned among other layers. Lithological column consist of number of consecutive sediment cycles of basin cross plane bedding become gradually more fine as it directs upward. The thickness of the sediment cycles is about (5-2m). The ground water level locates at depth more than 15m.

دراسة مصدر الركام ومواد التعبئة في غرب ألقرنه والمنطقة ألمجاورة لها، جنوب العراق

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الخلاصة

إن منطقة حقول غرب ألقرنه منخفضة طوبوغرافيا وتمثل جزء من منطقة اهورار مجففة. تتكون ألقبقة العليا من ترابه غير متماسكة هشة ذات انضغاطيه منخفضة جدا و بسمك حوالي ١ م غنية بالمواد العضوية وهذه التربة غير صالحة لإنشاء مصاطب لأبار النفط بارتفاع مناسب وإقامة شبكة طرق تربط هذه الأبار مع بعضها ومع الطرق الرئيسية بالمنطقة. فحصت مقاطع ألقربة حقلها بالعين ألمجرده. أخذت إحدائيات المقاطع المذكورة باستخدام جهاز GPS والتقطت صور فوتوغرافيه لها باستخدام كاميرا رقميه. استخدمت صورته فضائيه خام محسنه ملتقطه بالقمر الصناعي لاند سات بتاريخ ٥-٦-٢٠٠٣ تغطي الصف ٣٩ والمسار ١٦٦ . استخدم برنامج ايرداس الإصدار التاسع لتهيئة ألقصوره ألقضائيه بشكل يخدم غرض الدراسة. استخدم برنامج ARC GIS الإصدار التاسع لرسم خارطة رقميه لغطاء واستخدامات الأرض و لغرض تسقيط مواقع المقاطع المدروسة على الخارطة المذكورة. تم التأكد من إن منطقة حقول غرب ألقرنه تخلو من أي مصدر يصلح لتجهيز الركام (الرمل والحصى والسبيس) وان مقطع ألقربة لغاية عمق ١٢م يتكون من طين عضوي وطين مارلي وطين غريني ومن عمق ١٢م ولغاية عمق ١٧م هو عبارة عن غرين رملي ومن عمق ١٧م ولغاية ٢٠م يتألف من رمل ناعم وبعد عمق ٢٠م تظهر طبقه تتكون من حجر رملي بالاضافه إلى أن مستوى المياه الجوفية هو ٦م. من جهة أخرى تغطي الرمال معظم الجزء الجنوبي من

منطقة الدراسة المتاخمة لمنطقة غرب القرنة، أما الجزء الباقي منه فيكون مغطى بطبقة الجبريت. تزداد النسبة المئوية للرمل قياساً بالحصى كلما اتجهنا من الجنوب الغربي إلى الشمال الشرقي. يختلف الحصى الموجود من حيث الحجم. يوجد حوالي ثلاثون مقلع لمواد البناء من المتكتلات تتراوح أعماقها من (٥-١٢ م) رواسبها من النوع المتطبق. توجد الرواسب في بعض الأحيان على شكل عدسات متوازية أو شبه متوازية بين بقية الطبقات. يتكون العمود الصخري من دورات رسوبية متعاقبة من طبقات التطبيق المتقاطع الحوضي التي تصبح تدريجياً أكثر نعومة باتجاه الأعلى. يتراوح سمك الدورات الرسوبية من ٢ إلى ٥ م ويقع مستوى المياه الجوفية على عمق أكثر من ١٥ م.

Introduction

West Qurna is one of the biggest oil fields in Basrah Governorate. It has certain oil reserve estimated by 18 billion barrel, and possible reserve of about 40 billion barrel. The present product is 620,000 barrel/day, and it could be reached up to 1 million barrel/day. It is light and wanted all over the world. The productive oil reservoir are: - AlMushrif, AlSaedy, and Al-Zubair, total number of wells are 247, the number of Water Injection Station are 64, and 3 degassing stations [1]. [2] studied the geology of Al-basrah governorate. [3] studied environment and morphology of southern Iraq marshes. He described their environment and assessment of morphological situation. He also performed some of analysis for preliminary soil properties. [4] studied geomorphology of Haur Al-Hmar and adjacent area southern Iraq using remote sensing data and GIS techniques. [5] studied geology of Iraqi southern desert. An investigation was carried out by [6] on location 6-camp. The purpose of that investigation was to explore the subsoil conditions of the proposed site for the construction of ENI Camp Structure at West Qurna Oil field- Location 6- of Al Basra governorate. [7] perform identify concentration feldspar in some of sand deposits, southern Iraq. The purpose of the current study is to find the nearest sources of the aggregate, fill material and construction stuff within the WQI field (Onsite) or adjacent the WQI field (Offsite) area.

Description Of Study Area

The studied area is estimated to about (3269 km²). It extends between latitudes (N 30° 19' – N 31° 0') and longitude (E47° 6' – E47° 33') **Fig.No. 4**. It is worth mentioning, the map in **Fig. No. 2** represent only the north part of study area. The study area is bordered from north by Missan province, west Thi Qar province, south Basrah province and from the east Republic of Islamic Iran. Basrah governorate is located in south of Iraq, (32° 46' - 48° 42') longitude and (29° 06' - 31° 19') latitude. Qurna is a town within Basrah governorate, its area is about 2,665 km² [8]. It is located north-south of Basrah governorate, Fig. No. 1.

Methodology

The study is divided into two main methods:-

1-Field work:

Visits were held to onsite and offsite west Qurna area respectively, 3269 km². Visual tests were performed for samples taken from exist soil sections of 1.5m and 4m deep, 50m to 200m long. Other samples were taken from holes dug manually or with backhoe by our supporting group or from lithological sections. Nineteen sites were visited and located by GPS "Garmen 12". Photos were taken by digital camera, see appendix.



Figure No.1: A map illustrating the location of the study area

2-Labrotory work:

Raw satellite images, captured by Land sat in April 5th, 2003 was used, type of that images is ETM + path 166 Row 39, by using ERDAS v.9.1 bands 1,2,3,4,5 and 7 with resolution of 28m, were added to make colored image, the thermal bands were excluded because they are not important for the study, then the colored image merged with the 8th band "Panchromatic 14 resolution" in order to get a colored image of 14 resolution. The colored image was imported by GIS v.9.3 software, georeference was performed, the coordinates of the sites taken by GPS were set, a map for roads, important sites, etc.. were drawn in land cover land use map.

Topography Description

The west Qurna oil fields area is characterized by flat topography, where the elevation of the overall study area ranges from (0.5m) to (2m) above sea level. However. The surface of southern part of study area (offsite) is characterized by low gradient. The slope is from NW to SE. This slope ranges between 1/16800-1/17400 m. The area is considered as a syncline filled by ancient continental shelf deposits and covered by recent alluvial deposits. It is surrounded by rising earth from north, west, and east. The landform is as a wide depression with some low broad crusted hills. There are some of small relief. The southern part of study area represents part of southern desert which considered as sandy bubbly plains with the existing of separating hills and low sinks. Sand duns abound at western part. Within Dibdibba plain exists isolated stone dome (Jabal Sinam).

Geomorphology Description

As result of negative tectonic movement for marshes area, will led to a state of tectonic subsidence and immersion by water of rivers and extinction the old life in that area, while the positive tectonic movement led to separate the marshes area, then the Tigris and Euphrates rivers and their branches will continue deposits rivers sediments in lower area (marshes). Also will deposits Aeolian and biochemical sediments which led to equilibrium status or environmental equilibrium with operating of tectonic subsidence. Erosion was by water or air. The slope of area is plane in all locations. Relief of this part of study area are classified as third order. Generally, the area covering by marshes environmental sediment, which consist of clay, silt and dissolved salts. The west border of the Onsite of west

Qurna oil fields is 4m wide artificial river, the south border is the main outfall Drain, Fig. No.2. A bout 2km north west DS8, there is a layer of sand, 1m thick, covered with clay. After inquire the local people, we found out that it was part of an old unfinished abandoned construction project. This part of study area locates within one physiographic province (Mesopotamian Plain). The geomorphologic unit which was differentiated in the study area is Unit of Fluvio-Lacustrine Origin / - Marsh

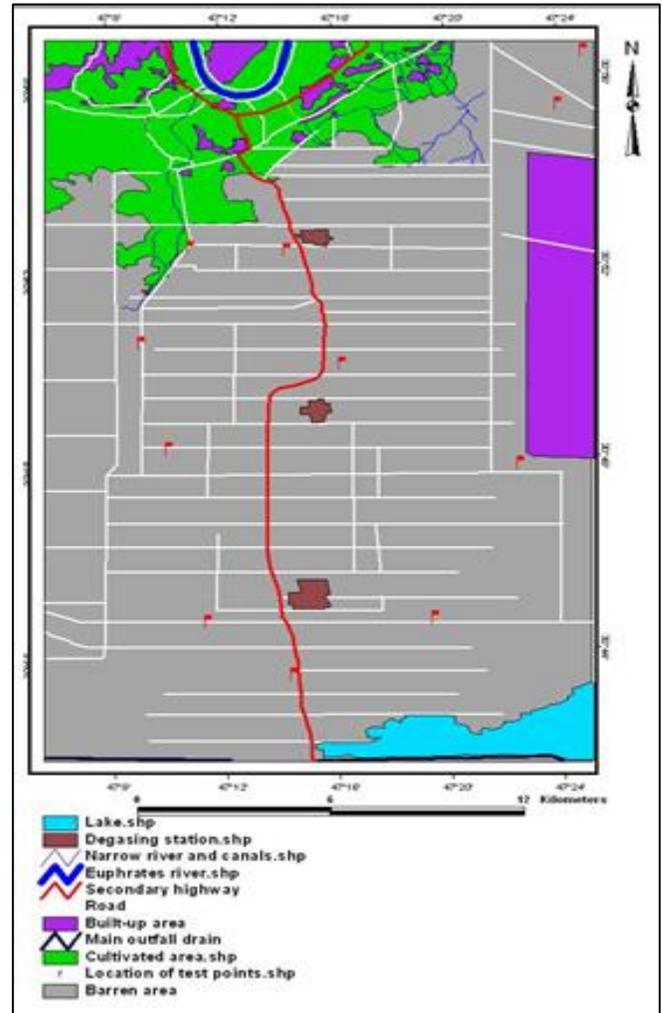


Figure No.2: Land cover land use map of onsite west Qurna area

While the Oofsite area of west Qurna oil fields locates at other physiographic province (Southern Desert). It differ in geomorphologic characters and processes. The geomorphologic units which were differentiated in this part of study area are:

1- Unit of aeolian origin
a- Destruction landforms

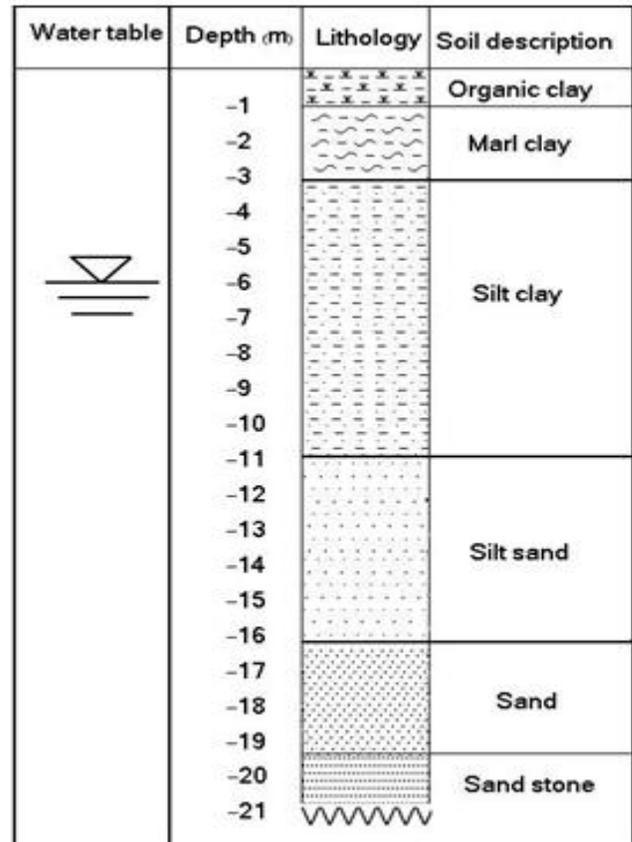
Results

The Onsite of west Qurna oil fields is covered with about 1m thick of soft layer of sediment belongs to the recent geological age, rich with remnants of shells, oysters, snails, reeds and other plants. These remnants are mixed with granular grey clay. In general, it could be described as organic clay, and geologically as flood plain sediments. There are a lot of holes and furrows that show sections of the soil. They are about (1-4)m deep. The general description of the section from top to bottom as:

- 1- The above mentioned top layer is about 16m thick sediments of marshes.
- 2- Brown marly alluvial sediments.
- 3- Black green silt clay.

At 17 m deep, there is a black grey sand, then sand stone layer. The water table is about 6 m, as shown in Fig. No.3. While the results of Oofsite west Qurna oil fields are:

- 1-The granular sand spreads economically, which cover a very wide area of the southern part of study area. Another part covered with new sediments of the Gypcrete alluvial fan.
- 2- The percentage of the sand increased as the gravels decrease from south- west to north- east. Near Al-Matar area, gravels in the soil sections have big size and large quantities comparing with chwebdah area.
- 3- The gravels have different, color and shape. As a size, the smaller is granule, and the bigger like cobble as maximum.
- 4- There are about 30 out crops utilized as aggregate quarries for construction. They are about 5-12 m deep , the average is 8m deep. Their sediments are layer type. Sometimes, the sediments lens type are parallel or semi parallel, positioned among other layers.
- 5- The aggregate could be described, lithologicaly, as a sediment of soft granular sand, consist of number of consecutive sediment cycles of basin cross plane bedding and become gradually more fine as it directs upward. The thickness of the sediment cycles is (5-2m) approximately, these cycles indicate to the deltic alluvial origin.



Scale 1:100

Figure No.3: Typical profile of soil and lithological column for onsite west Qurna

- 6- Most of the gravel are metamorphic origin in addition to sedimentary rocks, because the source of most gravel are Quartzite metamorphic rock and limestone sedimentary rock.
 - 7- The ground water level locates at depth more than 15m.
- figure No.4 shows distribution map of no finding and finding aggregate's areas and the prevailing type in it. While figure No.5 shows lithological column, then observe the area was covered by approximately hard bed. This bed contain from mixture of clays, sand, carbonaceous materials, and secondary gypsum, become definite overburden. Sometimes was covered with aeolian deposits. Thickness of gypcrete bed is about (0.5- 3)m which increased toward south and western south of area.

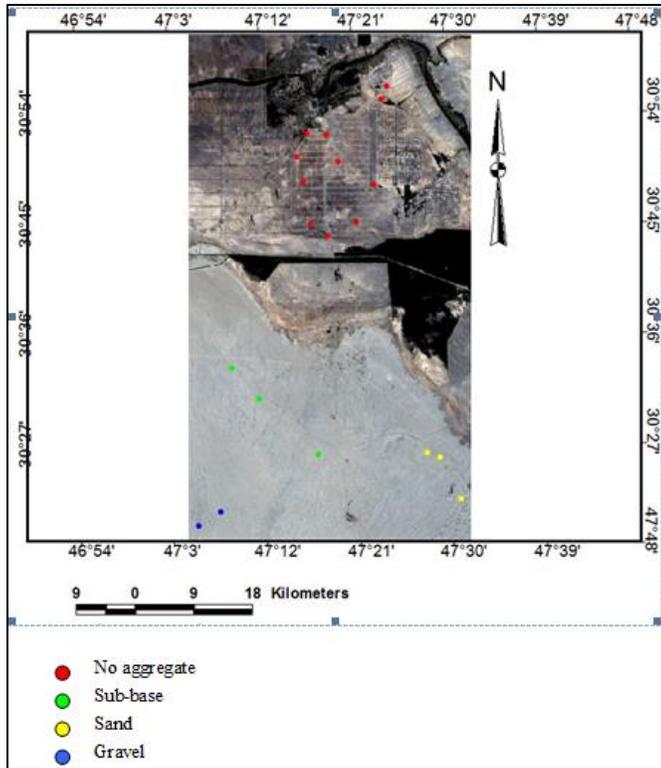


Figure No.4: distribution map of no finding and finding aggregate's areas and the prevailing type in it

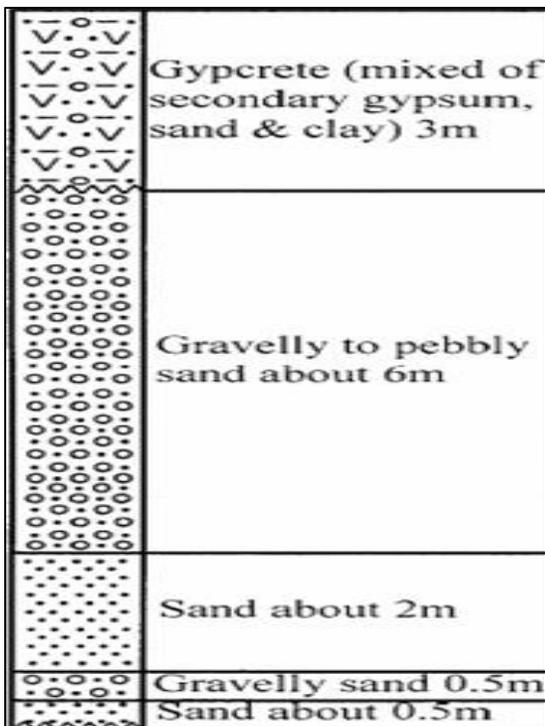


Figure No.5: Lithological column for offsite west Qurna area

Discussion

There is no any kind of aggregate within **Onsite** area of west Qurna oil fields except the southernmost zone, at 12m deep, there is a black grey silt sand, at 17m deep, there is a grey sand rich with acidic materials, so it is not compatible with engineering specifications. This result is agreement with the result recorded by [6]. The grey color indicates that this layer is deposited in swamp area "reduction environment" , because lack of oxygen lead to dissolve the plants of the marshes by bacteria and transform them to dark organic material (humes), and release the oxygen which change the water into acidic one [9]. The acidic water help to melt the rock minerals, and eventually form sand not suitable for engineering construction. It is well known that the process of utilizing aggregate quarries is not economical below 15m deep, water table at 6m is an additional obstacle. The reason that there is no aggregate in the **Onsite** is:- The study area is a part of plateau which has been severely eroded and became lowland, receives fragments of rocks comes from high lands. Besides, the multi sources accumulated sediment, belong to evaporates, sand-dune and flood sediment of Euphrates river. This lowland could be a part of the flood plain which received a little sediment. It has been fed with water from Euphrates and Shat AL Arab rivers, a wide area called the Marshes was formed [5]. This Marshes area is rich with oil, but exploring and producing oil cost much money comparing with dry land., for this reason, the government decided in July 1992 to dry it, by stop feeding water. So , a water gate built on all branches feeding the marshes, a high dykes built on the two opposite banks of Euphrates river in order to prevent overflow water from getting into the marshes[10]. On the other hand, analysis of the **Offsite** results is as the following: Most of the coarse and coarser aggregate concentrated near Al-Matar area, while the medium and fine concentrated near Chwebdah area. This result differs with the result recorded by [7]. The reasons of the above phenomenon could be as follows: the sources that provided the coarse sediments had no enough energy to push them far away from the source, so the deposited closed to the source "the beginning of flood alluvial fan". The medium and fine aggregate deposited away from source "end of the flood alluvial fan". The sediments of Al Batin alluvial fan is covered with (0.5-1.5m) thick layer of Gypcrete. This result disagree the result described by [7]. The reason could be the weather conditions for the area, such as temperature

and range of rain, for Albatin alluvial fan with dry weather.

Recommendations

In order to build a well pad, and connect them with the roads, we recommend to remove the soft top layer to at least 1m deep, because it is loose soil with very low compressibility. The removed soil should be replaced with new one, and to be compacted to acceptable specifications. Since there is no aggregate within Onsite study area, the Offsite area is to be explored. In addition to southern part of study area as we did, we recommend to be explored within part which lying north of west Qurna oil fields , especially in Chlat area near the Iran-Iraq border within Al-Amara city where find two huge sources of aggregate (Al-Tieb and Dwariej) alluvial fans.



Some of check points which were tested at onsite and offsite west Qurna area.

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