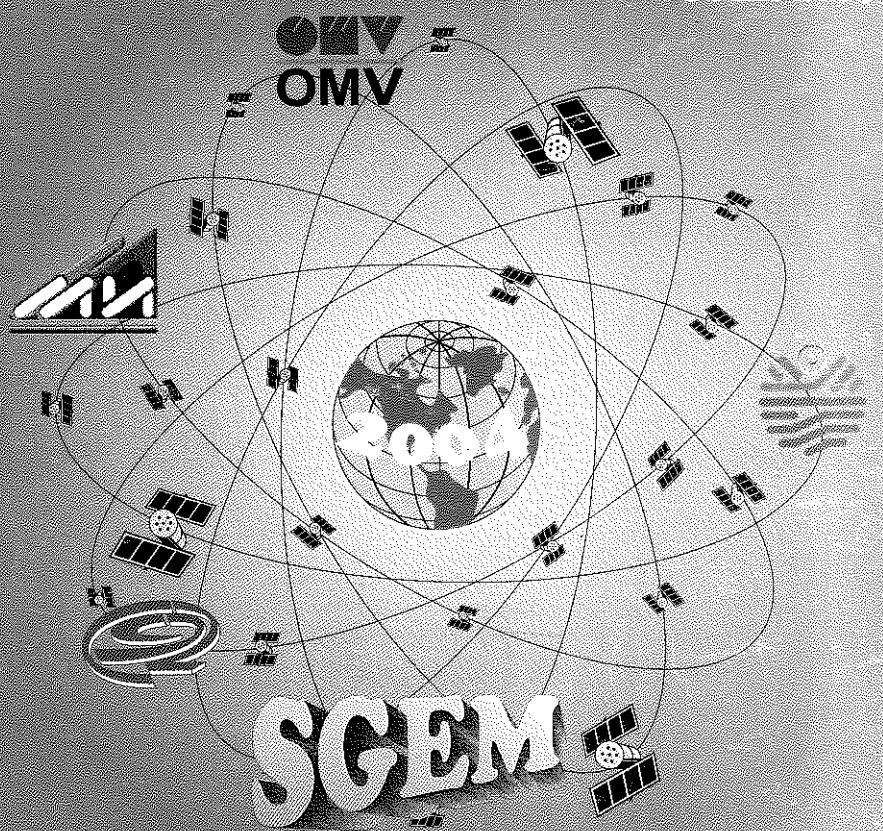
International Scientific Conference

SGEM 2004



Modern Management of Mine Producing, Geology and Environmental Protection

OMV

FALCON OIL & GAS Ltd.

CONTENTS SGEM 2004

SECTION I: GEOLOGY OF THE SOLID MINERAL RESOURCES, NATURAL GAS AND OIL

SGEM
14 - 18 June, 2004, Bulgaria

THE EFFECTS OF THE NEW FIELD USING IN THE SURROUNDING OF ATATURK DAM IN SOUTHERN TURKEY

İ.Erdal KEREY, M.Ziya GÖRÜCÜ

The University of Istanbul,
Department of Geology, Istanbul, Turkey

ABSTRACT

The studying area is placed on the surrounding of Ataturk Dam in Bozova (S.URFA) in the southern Turkey. The main lithology of the region starts calcareous marl and upper part is consist of lime stones with crystalline dolomites and chert.

In the region there are some important climatic changes which took place during the accumulating water in the lake of the dam. These situations caused many new environmental and agricultural effects. Especially the geochemical features of the lithological unit of the region roles in these changes. For example: quantity of the calcium and potassium in the soil are twice more then before. In addition pH, ions and minerals quantities of the soil are different now. Although the evaporation in the region faster then before but falling is 35-40 mm. This situation is also caused the evaporates which are seen in arid climates. Evaporates accumulated in the soil as the salts of the sodium, calcium potassium and magnesium.

These chemicals which are accumulated in the lower part of the soil made unproductive the vegetable soil. On the other hand the main ions and minerals are washed from the upper section of the vegetable soil after watering. Besides of this the moisture of the region now is higher and this is also effective in this changing. These reasons need that we must give importance to grow the vegetable which is suitable with the main lithological units in order that we could prevent to lose top soil. In addition we could change the plant cover as well. One more topic is important to keep the watering enough not more. Due to do this method it is possible to make richer or to keep the minerals and ions in the soil.

If it wouldn't make anything, the soil in this region will lose its important elements and some salts such as Ca^{+}, Na^{+}, CO_3^{--}, HCO^{-}_3, Fe^{+}, and FeO would be richer soon. The areas like these are exist several countries such as India, Pakistan and some other countries which placed in tropical zone of the world.

Key words: *Soil ,arid, climate, evaporation, geochemistry, land, use, Bozova, Ataturk Dam*

THE GEOLOGICAL EVOLUTION OF THE REGION

Bozova (Ş.URFA) region seems as a foreland basin which was effected by the general tectonics evolution of South Anatolia beginning in Creteceous [1]. It is understood that the region was taken place due to Arabic Plate went forward on

Anatolia Plate along the ancient Tethis ocean. [2]. In South Anatolia region some sediments deposited during this overlaping in Cretaceous as well. [3].

Bozova region places on the south of this collisional zone and it appears much less effected from this ovarlaping zone. In the region deformation effects could be seen in the Bozova fault and its narrow zone. In generally the region looks as an undeformed zone. On the other hand this area shows more tectonics deformations in Paleocene. In Eocene and Oligocene there are much deformation especially during Pirenien orogenesis and the this term includes lots of large and small faults as well. [4].

In Creteceaus the region was a highland but in Paleocene sea covered up the region. This sea started to get lower in the end of Paleocene. During this term there was a volcanic activity which caused the sedimentation of the limestones with cherts. [5] In Oligocene the sea regressed and non-marine sediments deposited together with volcanic activity almost finished in this time. Terrestrial sediments deposited in Pliocene and Quaternary. [6] (see appendix 1)

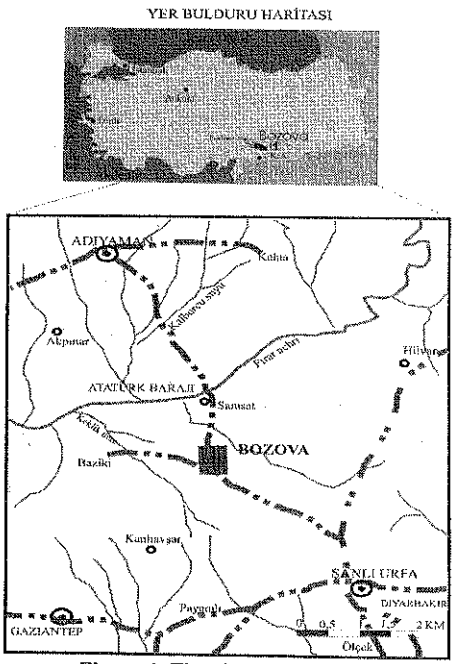


Figure 1. The plan of the working area

SOILS

The typical feature of the soil which formed in moist region is the fact that the increasing of the amount of the aluminum silicates and iron oxide in B level of the top

soil. These type soils are called Pedalfer. On the other hand the dry climate region's soil includes calcium salts deposited. These second type soil is called Pedogal. The difference of these two type soils is the annual falling. The limit falling is at least 65 cm. in a year for the moist regions [7].

The most common soil in the moist regions is called Podzol. These soils are characteristic for the region of the moist and warm climate. In addition these are also forest soils which place in the north of the hot zones. In these region there is a hard plant cover and it causes high acidite in the soil water. Therefore the pH of the soil is between 4,0-4,5 in clayey level of this type region. In humus this value is 3.5. This acid water washes alkali and earth alkalies from level A of the top soil. Furthermore this acid is strong enough to take iron and aliminum from the top soil as well. Level A is rich about silica and its caharacteristic color is grayish white. The importance of this event is that althought all alkalies and earth alkali ions are taken by solitions, iron and aluminum which are moved from level A deposites in level B as hidrate, iron oxide and colloidal materials. The pH value of level B is high. In addition level B includes large clayey levels as well.

The other type soil belong to hot climate is the red soil that is seen generally in equatorial zone and it is called laterite. The characteristic feature of this soil is the fact that iron and aliminum oxide get rich but silica and alkali get poor along the profile of the top soil. This process like a forming of Podzol. However it looks as an more advanced prosess. Because alteration is faster and deeply. On the other hand these are not only soil of the tropical region and another soils which include kaolinite are also exist in the area like that. The soils near the equatorial zone generally include aliminum, iron oxides with clay minerals and these features are characteristic. These type of soils are seperated from laterite. The color of these are red, red-brown and yellowish-brown and iron oxide which exist in the soil causes this color.

Dry climate soils are characterized by accumulating of calcium salts in any level of the soil profile. The reason of this is the fact that rain water stay in the soil to diffuse and to move in narrow channels. Mainly rain water is absorbed from the soil due to capilarity. After that this water move to the upper level of the soil. Then some salts such as magnessium and aluminum place in the top. This salts are soluable and in advanced process they move by washing from the top soil. However calcium also move and accumulate by capillarity in the top soil. After evaporating calcium salts deposited in the soil.

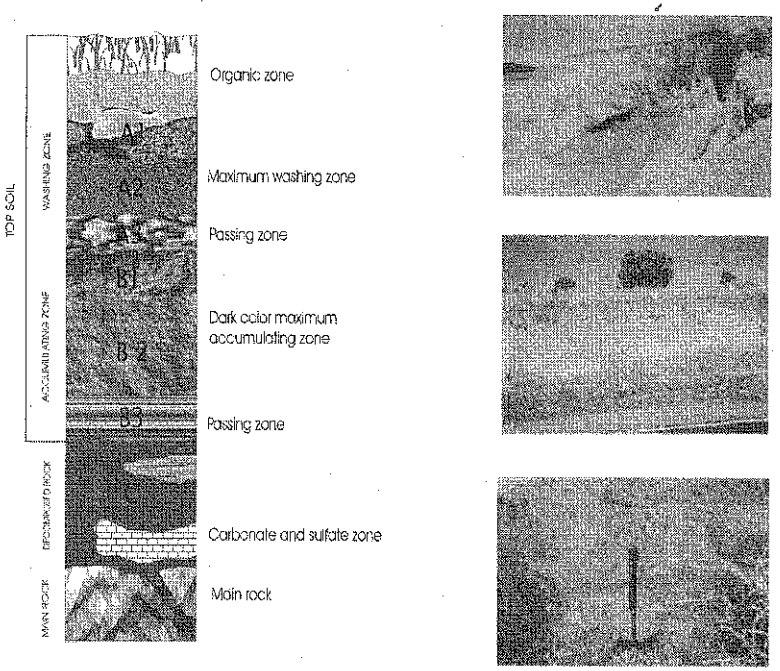


Figure 2 The soil zones of the region

The mainly calcium mineral in nature is calcium carbonate. Sometimes it find with gypsium. In the regions with annual avarage falling is less than 65 mm per year this salts deposition is in B level between 1-4 meters. The more drought the less depth is needed to accumulating salts. Finally this salts level reachs to the face of the soil and it calls caliche [8]. Caliches form dry regional deposition. In the area like this, the plants cover doesn't decompose faster or slower than other type region. Therefore the soil water in these regions keep alcalinity to solve carbonate and silica minerals. It is seen large amount of montmorillonit in these area.

One of the well known soils in arid region with pedogal charachter is chernozom which is seen rich about organic matter and darkcolor. In this soil carbonate is relatively richer. Annual avarage falling is less than 65 cm per year. This soil is the best for agriculture in arid region. Because it is rich about organic matter and its ions weren't moved away by washing. The more drought is the finer grain includes and its color becomes lighter. Chernozom soil types includes many color, such as red-brown or dark brown. If the drought is excessive the soil is includes salts like NaCl. This last type is called Salin.

SUSPENDED MATTER IN RIVERS

It is understood that the importance is on source area for a river. Because the source area determine the ion concentration of a river. This composition is determined by the soil which form from the main litology of the region. We have to take on attention to the suspended material of a river. Therefore if it looked at the avarage of ion concentration of the rivers in the world, it could be seen that the general composition is approximately similar to following table, althought this values are ppm. Actually the material which is moved to depositional area by river includes very little salt and its density is mostly 100 ppm or rarely 1000 ppm. [7].

Table 1. The analysis of rivers (ppm)

	A	B	C	D	E	F	Avarage of the world
HCO_3^-	93	101	183	108	149, 2	17, 9	58.4
$SO_4^=$	25	41	289	19	0, 44	0, 8	11.2
F-	0.0	0.1	0.2	0.5			
CI-	5.0	15	113	4.9	8	2.6	7.8
NO_3^-	1..2	19	10	0..3	0.44	1	
Ca^{2+}	32	34	94	23	17.4	5.4	15
Mg^{2+}	4. 9	7. 9	30	6.2	5.2	0.5	41
Na^+	4.8	11	124	16	30.7	1.6	6. 3
K^+	2.0	3.1	4.4	0.0	11.8	1.8	2. 3
Fe	0.07	0.02	0.01	0.280	1.9	0.67	
Al	0.304	1.01	0.012	0.238			
SiO_2	4. 9	5. 9	14	13	25.6	10.6	13.1
Total suspended material	173	221	583	191	249	43.1	120

A. Hudsun River, Green Island, N.Y
B. Mississippi River ,Baton Rouge,La. E. White Nil ,near Hartum, Sudan
C. Colorado River , Yuma ,Arizona.
D. Colombia River, 3 mile north of Dallas,Wash.
E. White Nil, near Hartum
F. Amazon River, near Obidas

Modified from Livingston, 1963

Suspended materials in rivers and conjectural average values for the world as above. These values are not only material which is moved by rivers and erosional processes but also it includes moved materials to the oceans by wind. On the other hand the suspended material amount of any rivers depend on the climate of the region. Furthermore the kind of suspended materials of a river directly related to the litology of the river chanel. For example the large amount of Ca^{++} indicate that the litology is limestone and Mg^{++} shows the area with dolomite, and alkali metal, silica shows granitic area. Besides of this plant cover, absorbsion and other mixed materials effect the composition of the rivers. But this last factor is controlled by the climate of the region. In moist climate CO_2 rate is more, because of the plant decomposition. It

causes that rivers become with high density about CO_2. In this way river become asidic and this make the water of the rivers rich about cation Ca^{++} and anion HCO^-_3 in moist climate regions. This also easily solve limestones. But in dry climate the strengthenning of CO_2 is quite poor. Whereas CO_2 make neutral the alcalinity which come into during hydrolysis. So Ca^{++} and CO^-_3 deposite in B level of the top soil and the water become richer than before about Na^+, $SO^=_4$ or Cl^-. On the other potassium rate stay the same in soil and it doesn't matter whether what the climate is

THE MECHANISM OF FORMING SALTS IN A REGION

The soil with salts in dry region usually contains some salt ions such as Cl^-, $SO_4^=$, HCO_3^-, NO^-_3, Na^+, Ca^{2+}, Mg^{2+}, K^+ There are three main reasons of the fact that these anions and cations get richer in the soil . those are;

1. Main litological rock unit
2. Alteration of the minerals
3. The composition of the face and groundwater in the region

The first reason above explains that main litology determine ion type and concentration. Because mainly this litology decompose and alterate and can supply the ions.The second one is explains that minarals are compounds of elements and when the environmental effects causes alteration then ions form from this minerals. The thirth one is that the composition of the face water and groundwater which is determined by litology and environmental conditions causes these ions as well.

On the other hand closed basin causes salinity in the top soil. Because the water accumulating in the soil can not move to another place and take place salinity during evaporating. If the region is rainless the same thing occur. The reason of this is the fact that ions can not be washed and moved from the basin. In addition when the groundwater get higher to near the face of the soil, salinity approach to the face as well. The groundwater level is approximately 2 meter is in dry region.

THE SITUATION IN THE REGION

1. The working area is a closed basin and its climate is dry too. Avarage falling is less than 400 mm. per year

2. The region is rich about ions such as Cl^-, $SO_4^=$, HCO_3^-, NO^-_3, Na^+, Ca^{2+}, Mg^{2+}, K^+

3. The reason of this richness is the main litology which consist of limestones, clayey limestones, claystones and some other terrestrial sediments.

4. Some rocks called marl that placed in the bottom of the region prevent the water leak to deep of soil make an imprevious rock in the basin. This causes the accumulating of the water in the top soil.

5. The catchement area of Atatürk Dam is rich about salt ions and this water is moved to the agricultural area for watering.

6. Some measurements belong to the different place of the region is follow and this table gives an idea about the salinity in the region.

Table 2. Some values of the different place of the region

	Mülkören	Bozova	Saluca	Yaslıca	Safköy
Agricultural soil					
Thickness (m)	1,5	2	1,8	2,2	1,5
Salt Forming					
Depth (m)	1,2	1	1	1,3	2
Main Lithology	Limestone	Marl	Marl	Marl	Marl
Main Lithology					
Depth (m)	2	2,2	2,3	2,5	2
Calcium					
Carbonate (%)	84,15	86	73,4	68	87,3
Sodium					
Clorate (%)	11	12,2	24,2	27,3	12,2
Calcium Sulfate					
(%)	2,85	3	0,2	1,4	0,5

It can be said that the moisture of the soil will be richer than now when the watering starts by using the new watering project.

Once cover plant grow two important effect would occur.

a. When the cover plant in the catchement area of the dam grow, the values of carbon dioxide and humic acid would increase rapidly.
b. This Humic acid would solve the main litology faster than before and the region would be richer about salt ions such as Cl^- , SO_4^{--} , HCO_3^- , NO^-_3 , Na^+ , Ca^{2+} , Mg^{2+} , K^+ . In addition this new situation would make water dense about ions.
c. This water would cause to make the garoundwater level higher than before and in this way salinity level would approach to the face. In the course of time in the region would occur desertification.

REFERENCES

[1] GOSSAGE, D. W., (1956) Compiled progress report on the geology of part of Petroleum District VI, Southeast Turkey: N.V. Turkse Shell, Report no: GRT.2,22p.

[2] KRUMMENACHER, R. and PERIAM, C. E., (1958) Geological studies in the Amanos Mauntains with some regional consideration: N.V. Turkse Shell, Report no. GRT. 11, 34 p. (Petrol İşleri genel Müdürlüğü Teknik Arşivi, Kutu no. 351, Rapor no.3)

[3] ERENLER, M., (1989), XI-XII. Bölge güney alanlarındaki kuyularda Mesozoik çökel istifinin mikropaleontolojik incelemesi: TPAO Araştırma Merkezi, Rapor no. 1364, 44s.

[4] TUNA, D., (1973), VI. Bölge litostratigrafi birimleri adlamasının açıklayıcı raporu: TPAO Arama Grubu, Rapor no. 813, 131 s.

[5] ŞENGÜNDÜZ, N. ve ARAS, M., (1986), XI ve XII. Bölgelerde Mardin Grubu karbonatlarının ve Karaboğaz Formasyonu'nun fasiyes dağılımı, diajenetik özellikleri ve çökelme modeli: TPAO Araştırma Merkezi, rapor no. 1005, 75s.

[6] GOSSAGE, D. W., (1959) Stratigraphic observation in the Tut area of District VI, Southeast Turkey: N.V. Turkse Shell, Report no: GRT.18,48p.

[7] AKYOL, A., İNAN, K.,(1985) Jeokimyaya Giriş. İ.T.Ü Kütüphanesi 1308, s.184

[8] ERİNÇ, S., (1958) Jeomorfoloji. İ.Ü Kütüphanesi s.234.

[9] CHIRAS, D.D., (1991), "Environmental Science" Action for a sustainable Future California. Third edition p.124-355

EK 1

BOZOVA(URFA) BÖLGESİNİN JEOLOJİ HARİTASI

MAHMUT ZİYA GÖRÜCÜ

ŞUBAT 2003