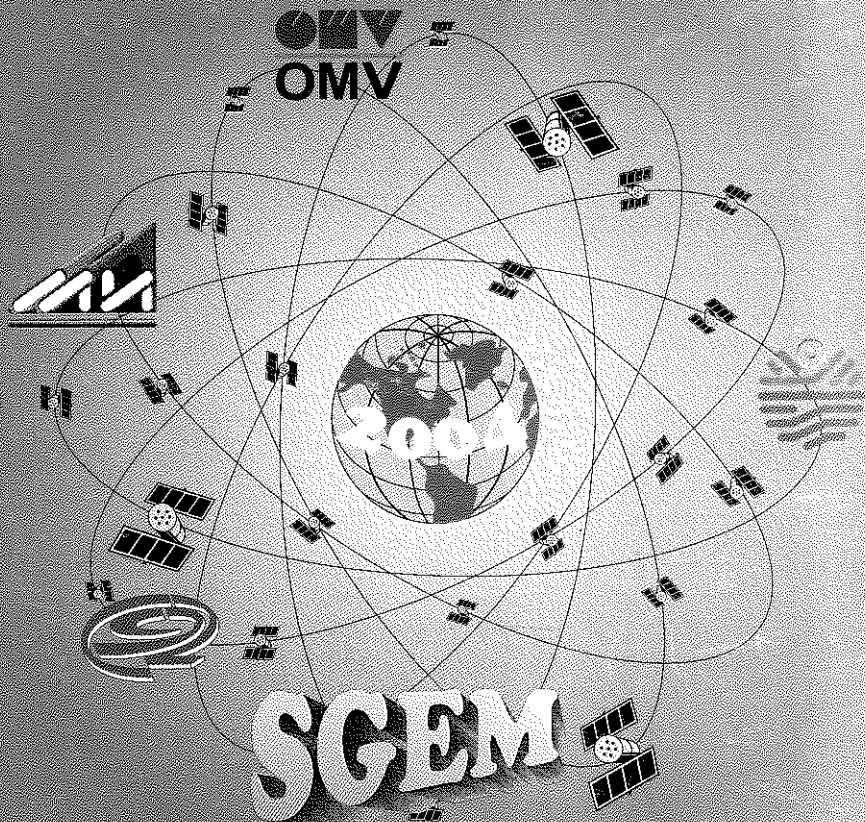


International Scientific Conference

SCGM 2004



**Modern Management of Mine Producing,
Geology and Environmental Protection**



FALCON OIL
& GAS Ltd.



**International Conference of Modern Management of
Mine Producing, Geology and Environmental Protection**

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CONTENTS SGEM 2004

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

- 1.1. Şahin, S. Y., Gungor, Y., Goker, F., MACROSCOPICAL AND MICROSCOPICAL EVIDENCES MAGMA MIXING/MINGLING TYPE INTERACTION IN KESTANBOL GRANITOID (SOUTH ÇANAKKALE), NORTHWEST ANATOLIA-TURKEY, *Turkey* 3
- 1.2. Yilmaz, I., Yildirim, M., PRE-INVESTIGATION OF THE KAT COUNTY LANDSLIDES IN THE NORTH ANATOLIAN FAULT ZONE (TOKAT-TURKEY): STRUCTURAL AND GEOMORPHOLOGICAL ASPECTS, *Turkey* 15
- 1.3. Hezarkhani, A., THE CALCULATION OF MASS CHANGES WITHIN THE ANDESITIC ROCKS AT SAR-CHESHMEH PORPHYRY SYSTEM, *Iran* 25
- 1.4. Vicit, M., Alp, I., Devenci, H., Celep, O., Kurbak, O., THE POTENTIAL OF THE AEGEAN PLACERS FOR PRECIOUS METALS, HEAVY MINERALS AND INDUSTRIAL RAW MATERIALS, *Turkey* 37
- 1.5. Hezarkhani, A., THE CALCULATION OF MASS TRANSFER AND ELEMENT MOBILITY IN SAR-CHESHMEH GRANODIORITE STOCK, KERMAN-IRAN, *Iran* 47

**SECTION II: TECHNOLOGY AND TECHNICAL EQUIPMENT FOR THE
OPEN PIT MINING OF MINERAL RESOURCES**

- 2.1. Mitov, S., Ninov, Kaimakchiev, A., Sultanov, Grancharov, I., Lechev, A., Majdrakov, M., ABOUT SOME PROBLEMS, CAUSED BY WASTE HEAPING WORKS IN ORE MINING, *Bulgaria* 63
- 2.2. Ulger, E., Dogan, T., Kahriman, A., Tuncer, G., Karadogan, A., Aksoy, M., THE EVALUATION OF OPEN PIT LAND RECLAMATION IN TURKEY CONSIDERING THE CURRENT LEGISLATION, *Turkey* 71
- 2.3. Smilyanov, A., Markov, I., Hristanov, D., Petrov, T., Balikov, V., MINE ROADS – AN INSUFFICIENTLY INVESTIGATED FIELD, *Bulgaria* 81
- 2.4. Markov, I., Smilyanov, A., Trapov, G., Hristanov, D., OPTIMIZING THE AVERAGE ANNUAL EXPENDITURE FOR REPAIR AND MAINTENANCE THROUGH BETWEEN-REPAIR SCHEMES, BASED ON POLYNOMIAL FUNCTIONS, *Bulgaria* 87

2.5. Markov, I., Smilyanov, A., Hristanov, D., Balikov, V., MINIMIZING THE AVERAGE ANNUAL EXPENSES FOR REPAIR AND MAINTENANCE OF MINE ROADS BY THE USE OF BETWEEN-REPAIR SCHEMES, *Bulgaria* 97

2.6. Trapov, G., Markov, I., Smilyanov, A., Hristanov, D., Balikov, V., BASES FOR INVESTIGATION OF THE CHANGE OF EXPENDITURE FOR MAINTENANCE OF ROADS BY THE METHODS OF STATISTICAL MODELING, *Bulgaria* 103

2.7. Smilyanov, A., Trapov, G., Marios, I., Hristanov, D., SOLUTION OF GOAL FUNCTIONS, COMPILED BY MEANS OF EXPONENTIAL FUNCTIONS, FOR OPTIMIZING THE AVERAGE ANNUAL EXPENSES FOR MAINTENANCE AND REPAIR OF MINE ROADS, *Bulgaria* 111

2.8. Markov, I., Smilyanov, A., Trapov, G., Hristanov, D., GOAL FUNCTIONS, COMPILED BY HYPERBOLIC FUNCTIONS, FOR OPTIMIZING THE EXPENSES FOR MAINTENANCE AND REPAIR OF MINE AUTOMOBILE ROADS, *Bulgaria* 117

SECTION III: TECHNICAL EQUIPMENT AND TECHNOLOGY FOR UNDERGROUND MINERAL RESOURCES EXPLOITATION

3.1. Andonov, E., FOR THE CONDUCT OF THE SYSTEM ROCK - PLIABLE SUPPORT, *Bulgaria* 127

3.2. Yilmaz, E., Kesimal, A., Ercikdi, B., PASTE BACKFILL PREPARATION AND APPLICATION FOR UNDERGROUND BACKFILLING PROCESS, *Turkey* 135

3.3. Siarov, G., CONCEPTION FOR QUALITY MANAGEMENT IN UNDERGROUND MINING OF MINERAL RESOURCES, *Bulgaria* 145

SECTION IV: GEODYNAMICS AND LAND SLIDING PROCESSES CONTROL. BLASTING TECHNICS AND TECHNOLOGIES.

4.1. Gospodinov, S., DEFORMATION ANALYSES OF RESULTS FROM GEODETIC MEASUREMENTS FOR LAND SLIDE PROCESSES INVESTIGATION, *Bulgaria* 161

4.2. Ramazi, H., Heidari, G., SEISMOTECTONIC AND EARTHQUAKE HAZARD ANALYSIS FOR HAMADAN AREA, *Iran* 171

4.3. Ercikdi, B., Kesimal, A., Yilmaz, E., SAFETY EVALUATION OF A HISTORIC PLACE AND SCHOOL CLOSE TO LIMESTONE QUARRY BLASTS, *Turkey* 181

4.4. Baliktzis, E., CONTRIBUTION TO THE 2004 OLYMPIC GAMES INFRASTRUCTURES PROVIDING ADVANCED BLAST CONSULTING SERVICES, *Hellas* 193

- 4.5. Karadogan, A., Kahrman, A., Tuncer, G., THE PEAK PARTICLE VELOCITY ASSESSMENT OF GROUND VIBRATIONS PRODUCED FROM DIFFERENT BLASTING SITES, *Turkey* 205

SECTION V: PLANNING AND MINING PRODUCING MANAGEMENT, MINING-TECHNOLOGY MANAGEMENT

- 5.1. Rokavec, D., MINERAL DEPOSITS IN SLOVENIA AND HOW DO WE MANAGE THEM, *Slovenia* 219

- 5.2. Kursun, I., INTRODUCTION OF TITANIUM MINERALS; MINERAL AND METALURGICAL PROCESSING TECHNOLOGY, *Turkey* 225

- 5.3. Dimitrijevic, B., Simic, R., Ilic, S., MODEL OF TEHNICO-TEHNOLOGICAL AND CONSTRUCTIVE PARAMETERS IN BOREHOLE MINING HYDROEXPLOITATION OF LOOSE RAW MATERIALS, *Yugoslavia* 233

- 5.4. Fecko, P., Skorka, V., Kucerova, R., Pectova, I., BACTERIAL DESULPHURIZATION OF COAL FROM MINE CSA, *Czech Republic* 245

- 5.5. Mitov, S., Ninov, Kaimakchiev, A., Sultanov, Grancharov, I., Lechev, A., Majdrakov, M., MEASUREMENTS FOR RESTRICTING THE OBTAINED ACID DRENAGE WATERS IN SPOIL HEAP IN ORE MINING, *Bulgaria* 253

- 5.6. Alp, I., Celep, O., Deveci, H., Yazıcı, E.Y., PROCESSING OF GOLD FROM MASTRA (GÜMÜŞHANE-TURKEY) ORE BY KNELSON GRAVITY CONCENTRATOR, *Turkey* 259

- 5.7. Alp, I., Özdağ, H., Deveci, H., Yazıcı, E.Y., MAGNETIC SEPARATION OF COLEMANITE FROM ORE AND TAILINGS OF KESTELEK (TURKEY) PLANT, *Turkey* 267

SECTION VI: INFORMATION AND GEO-INFORMATION SYSTEMS AND TECHNOLOGIES IN MINING, GEOLOGY AND ENVIRONMENTAL CONTROL

- 6.1. Siarova, M., MINING-GEOLOGICAL INFORMATION MANAGED WITH GIS MAPINFO, *Bulgaria* 277

- 6.2. Konechny, M., GLOBAL AND REGIONAL GEOGRAPHIC DATA PROJECTS FOR SUSTAINABLE DEVELOPMENT, *Czech Republic* 285

- 6.3. Popov, A., MATHEMATICAL MORPHOLOGY AND ITS APPLICATIONS TO GEOSCIENCES, *Bulgaria* 291

- 6.4. Karadjov, M., Velitchkova, N., Pentcheva, E.N., Petkov, I., HEAVY METAL AND AS CONTAMINATION OF WATERS, SOILS AND VEGETABLES IN KCM SMELTER SITE – GIS MAPPING AND MONITORING, *Bulgaria* 299

- 6.5. Siarov, G., ABOUT COMPUTER MODELLING OF MINES, *Bulgaria* 311

- 6.6. Malinov, P., INTERNET MANAGEMENT. HUMAN ECOLOGY, *Bulgaria* 323

SECTION VII: WATER USE AND PROTECTION OF WATER BODIES

- 7.1. Kerey, E. I., Gorucu, M Z., THE EFFECTS OF THE NEW FIELD USING IN THE SURROUNDING OF ATATURK DAM IN SOUTHERN TURKEY, *Turkey* 329**
- 7.2. Kim, G. Y., Koh, Y. K., Kim, Ch., Bae, D. S., Kim, H.S., GEOCHEMICAL STUDY ON AN ALLUVIAL AQUIFER SYSTEM OF THE NAKDONG RIVER BASIN FOR RIVER BANK FILTRATION IN KOREA, *Korea* 339**
- 7.3. Benderev, A., Petkov, I., Mihaylova, B., PECULIARITIES OF THE GROUNDWATER FLOW REGIME IN REGION OF THE KCM-PLOVDIV, *Bulgaria* 347**

SECTION VIII: ECOLOGY, PROTECTION OF THE ENVIRONMENT AND THE EARTH STRATA DUE TO MINERAL RESOURCES PROSPECTING AND MINING ACTIVITIES

- 8.1. Rehor, M., Safarova, M., Lang, T., HISTORY, THE PRESENT AND PERSPECTIVES OF THE NORTH BOHEMIAN BROWN COAL BASIN AREA RECLAMATIONS, *Czech Republic* 359**
- 8.2. Bandrova, T., POTENTIALITIES OF ECOLOGICAL MAPPING, *Bulgaria* 369**
- 8.3. Ustun, B., Agcioglu, A. B., Taner, M.U., Aytac, G. E., Yenal, Z., EFFECTS OF SOCIO-ECONOMIC STRUCTURE ON ENVIRONMENTAL MANAGEMENT MODELLING, *Turkey* 379**
- 8.4. Mladenov, M., Dimitrov, M., Nedjalkova, T., RADIOECOLOGICAL MONITORING AROUND THE WORKING AREAS ON THE SITES WITH URANIUM INDUSTRY, REHABILITATED BY PHARE PROGRAM, *Bulgaria* 387**
- 8.5. Schmid, Mladenov, M., Dimitrov, M., Voicheva, Tzvetanova, PROBLEMS OF RADIATION PROTECTION DURING THE EXECUTION OF PHARE PROJECT FOR REHABILITATION OF URANIUM INDUSTRY REGIONS, *Bulgaria* 397**
- 8.6. Atanassova, R., Kerestedjian, T., RECENT MINERAL DEPOSITION AND REMOBILIZATION PROCESSES IN CLINKER WASTE HEAPS IN THE VICINITY OF KCM SMELTER, PLOVDIV, *Bulgaria* 409**
- 8.7. Pentcheva, E.N., Atanassova, R., Karadjov, M., Satchanska, G., EXPERIMENTAL MODELING OF INTERPHASE AND BACTERIA INTERACTIONS IN HEAVY METAL AND AS POLLUTED AREA, *Bulgaria* 417**
- 8.8. Kesimal, A., Yilmaz, E., Ercikdi, B., ENVIRONMENTAL BENEFITS BY USE OF PASTE BACKFILL TECHNOLOGY FOR DISPOSAL OF SULFIDE-BEARING MINE TAILINGS, *Turkey* 431**
- 8.9. Delibalta, M. S., PLANNING OF SURFACE CONFIGURATION AND RECULTIVATION IN THE TKI/MUGLA BROWN COAL MINING AREA, *Turkey* 441**

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**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 Atatürk 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, Atatürk 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 overlapping in Cretaceous as well. [3].

Bozova region places on the south of this collisional zone and it appears much less effected from this overlapping 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 Pirenen 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)

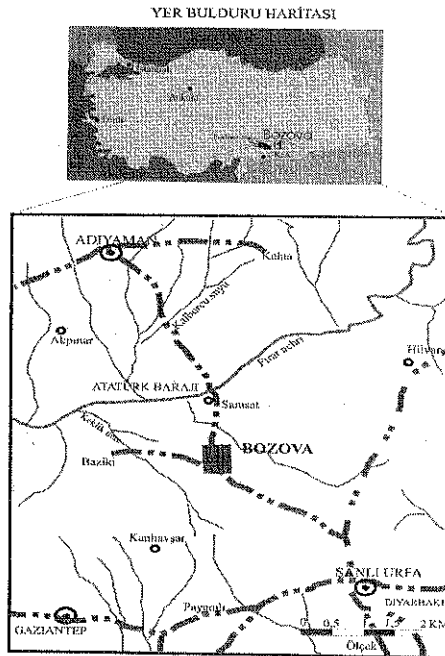


Figure 1. The plan of the working area

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 although all alkalies and earth alkali ions are taken by solitions, iron and aluminum which are moved from level A deposites in level B as hydrate, 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.

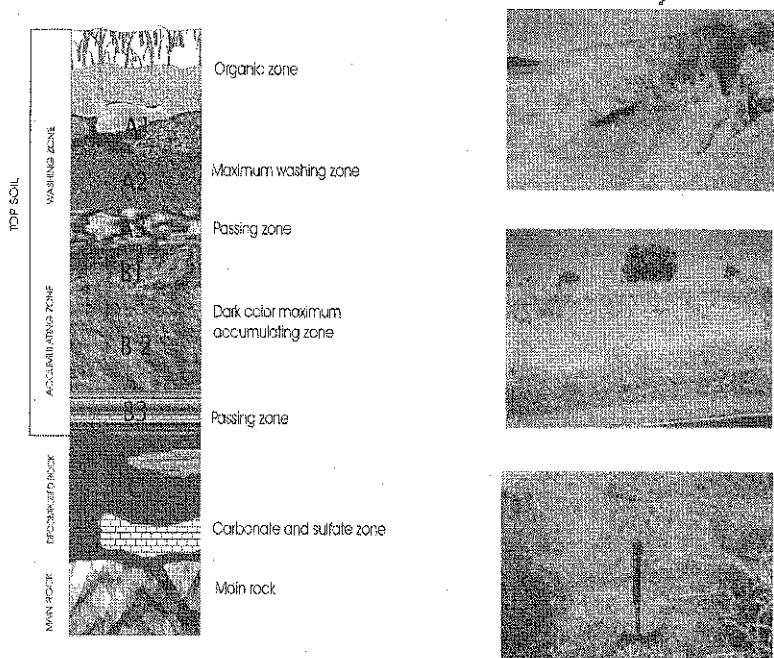


Figure 2 The soil zones of the region

The mainly calcium mineral in nature is calcium carbonate. Sometimes it find with gypsum. 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 reaches 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 pedoga! character is chemozom 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. Chemozom 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 average of ion concentration of the rivers in the world, it could be seen that the general composition is approximately similar to following table, although 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	Average 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			
Cl ⁻	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. Hudson River, Green Island, N.Y

B. Mississippi River, Baton Rouge, La. E. White Nil, near Hartum, Sudan
C. Colorado River, Yuma, Arizona.

D. Columbia 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, absorption 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 CO₂ 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 strengthening 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^+ , $\text{SO}_4^{=}$ 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^- , $\text{SO}_4^{=}$, 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^- , $\text{SO}_4^{=}$, 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 battom 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	Yaslica	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					
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.

- When the cover plant in the catchement area of the dam grow, the values of carbon dioxide and humic acid would increase rapidly.
- 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^{2-} , HCO_3^- , NO_3^- , Na^+ , Ca^{2+} , Mg^{2+} , K^+ . In addition this new situation would make water dense about ions.
- 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.

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