GEOKURDISTAN IV-2019

The Fourth International Geological Conference of Kurdistan

Abstract Volume

October 8-10, 2019

Sulaimani, Kurdistan Region, Iraq

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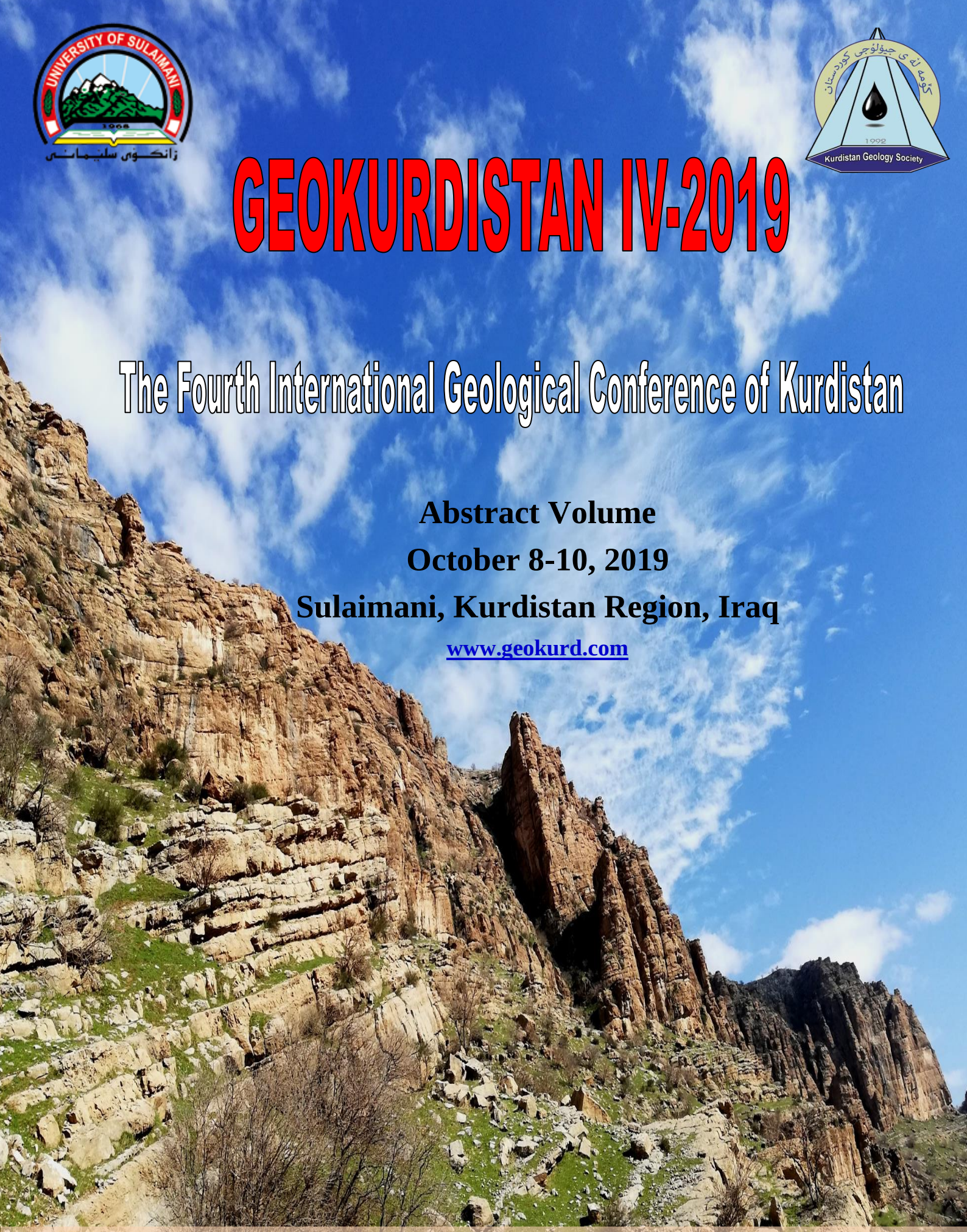

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In the name of God

Ladies and gentlemen...
Dear participants in the Fourth International Geological Conference of Kurdistan **GeoKurdistan IV**

Good morning
On behalf of the Department of Geology/ University of Sulaimani and the Kurdistan Geology Society, I would like to welcome you all and wish you a very pleasant and useful visit to Sulaimani. Also I hope that our meeting will be successful and continuing to achieve the main goals of GeoKurdistan Conference.

Dear Colleagues...
This is the fourth meeting of GeoKurdistan Conference and I am pleased that the number of participants increased in quality and in quantity. The number of researchers reaches 177 coming from 9 different countries. However, still no great progress and up–to-date geological studies have been done and they are not fully integrated with those in the outside world, except small numbers of researches. Only recently we have begun to cross our borders and publish studies of our region in international journals. There is a lot of work to be done in the next few years, which my ambition is that the related ministries of the Government support the academic studies in field of geosciences. In my opinion, one of the most important factors for geosciences locally is the absence of such meetings as this, which is very important for the exchange of ideas and building new models in geology.

Our goals for this conference are:
- To submit and discuss geological research on topics related to Kurdistan and surrounding areas.

- To determine the needs of geological studies in Kurdistan, and the deficiencies.

- To promote the participation of geologists from different areas and schools, which will create new ideas.

- To plan for new collaborative geological projects.

Indeed, the success of this conference will be dependent on your presentations, to be given here in the next couple of days. Our hope is that this meeting will become a systematic tradition, to be held every couple of years. Please write your opinions and criticisms about the conference in the feedback of the conference.I also would like to pay our respects to the Peshmerga, who martyred in defending our country and as part of the international fight

against terrorism. We will always remember them, and we also pray for those who have been injured in this war and wish them a speedy recovery.

It is my pleasure to thank all our sponsors; DANAGAS, Crescent Petroleum, Pearl Petroleum Companies, the Kurdistan Institution for Strategic Studies and Scientific Research, Halabja Group Companies, and the Fadhil Dgll Company, who faithfully support the conference financially. Also I would like to thank Kurdsat Broadcasting Cooperation for media sponsoring of this event.

Welcome again, and have a wonderful stay in Sulaimani

Ibrahim M.J. Mohialdeen
Chairman of the Organizing Committee
GeoKurdistan IV
8-10-2019
Sulaimani
Kurdistan

Organizing committee

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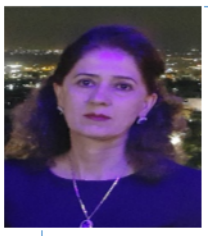

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Keynote speakers Biography

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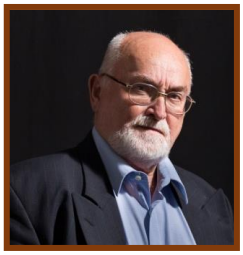

His activities in the fields; Geochemistry and genesis of ore deposits, Isotope geology, Waste disposal geochemistry and Waste management.

Dr. Palinkas Antun Ladislav Graduated from Faculty of Chemical technology, University of Zagreb, Croatia as Organic chemistry qualification. In 1972-1973 worked for INA, Oil industry, Zagreb, Department of Computer Engineering, From 1973-1988 worked as a Assistant -researcher, Chief of the geochemical laboratory, Team leader in uranium exploration campaigns for Mining-Geology-Petroleum Engineering Faculty, Dept. Mineral. Petrolog. and Economic geology. From 1988-1993 in Mining-Geology-Petroleum Engineering Faculty, University of Zagreb he was a Teacher in the graduate and postgraduate studies, Chief of the geochemical laboratory, Leader of field exploration campaign for gold-Borneo, Indonesia as an Assistant professor. Then between 1993 to 1997 worked for Mining-Geology-Petroleum Engineering Faculty, University of Zagreb a Associated Professor, after that in 1997-2006 he worked as full professor in Lorand Eotvoes University, Budapest, Hungary- 2010, Belgrade University, Serbia-2012, Wuhan University, China-2016, and Ljubljana University, Slovenia-2018.

Dr.Saffa A. Fouad

General Director of GEOSURV

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He was born in 1957. He graduated from the University of Baghdad in 1979 with BSc in Geology. He got his MSc in 1983 and Ph.D. in 1997 from the University of Baghdad in Structural Geology and geotectonics.

In 1984 employed in the Iraqi Geological survey, he is the General Director of the Iraqi Geological survey since 2016.

He is working as the Supervisor, lecturer, and examiner for the many masters and doctoral students in many Iraqi universities and published many papers in Iraqi, Arabic and international journals.

Dr. Stavros Kalaitzidis
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Dr. Stavros Kalaitzidis graduated from the Department of Geology, University of Patras, Greece, in 1997, and in 2007 concluded his Ph.D. in the scientific field of "Peatlands and Peatification Processes" at the same Department. From 2008 to 2014 he served in various positions in the Australian mining industry, initially in the exploration and mining sectors of BHP Billiton, and later as Senior Geologist at Integral Resource Consulting Ltd. based in Brisbane, Queensland. In 2014 he accepted an appointment to the University of Patras and currently he holds an Assistant Professor position in the field of Economic Geology, dealing mostly with ore geology and exploration. From 2008 till 2016 he served as Secretary of Commission I of the International Committee for Coal and Organic Petrology (ICCP), and in 2016 he was elected Chair of the same Commission for the 2017-2021 terms.

He authored and co-authored more than 40 papers in peer reviewed journals; his work received more than 800 citations in the SCI system.

Program of GeoKurdistan IV

Day 1 Tuesday 08th October 2019

09:00-10:00 Registration

10:00-10:30 Welcome Speech

10:30-11:00 Keynote: "Mesozoic metallogeny of the Neotethys in the Alps, Dinarides, and Carpathiens" **Ladislav A. Palinkas**, University of Zagreb, Croatia

11:00-11:30 Keynote: "Mineral resources in Iraq; prospects for development and available investment opportunities" **Saffa A. Fouad**, GEOSURV Iraq

11:30-12:00 Coffee Break

12:00-13:00 Session 1

13:00-14:30 Lunch

14:30-15:50 Session 2

Day 2 Wednesday 9th October 2019

09:00-09:30 Keynote: "Uncertainties in Source Rock Evaluation: the Advantages of Organic Petrology" **Stavros P. Kalaitzidis**, University of Patras, Greece

09:30-10:50 Session 3

10:50-11:30 Coffee Break

11:30-12:50 Session 4

12:50-14:20 Lunch

14:20-15:40 Session 5

15:40-17:00 Closing session

Day 3 Thursday 10th October, 2019 (Field Trip)

08:00 Departure from the Hotel by Bus

8:30 First stop Dolla Root

09:30 Second Stop SW limb of Sargelu Anticline

10:30 Third Stop Sargelu Village

11:30 Fourth stop Jafayaty Valley

12:00 Fifth stop Mokaba Village

12:45 Sixth Stop Waraz Village

13:30 Lunch

GK4-2

The influence of flow rate on formation damage at different pH

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Abstract

This paper focuses on the reduction of permeability (formation damage) as a result of fines migration by changing pH and flow rate on core plugs selected from sandstone reservoir of Pannonian basin (Upper Miocene, East Hungary). The main objective of coreflood experiments was to investigate the influence of both high and low pH fluids and the flow rate on stability of clay minerals. The selected core samples were examined by X-ray powder diffraction (XRD) for bulk mineralogical and clay mineral composition. The shape, position, distribution and type of clay minerals within the core samples were diagnosed by scanning electron microscopy and energy dispersive spectroscopy (SEM- EDS). The basic petrophysical properties such as porosity and initial permeability were determined prior to experiments. The influence of pH and flow rate on permeability reduction was examined through a series of laboratory coreflooding experiments, testing for acidic (3) and alkaline (11) solutions at different flow rates (50, 100 and 200 ml/h). Permeability in continuously reduced for pH 11 to more than 50 % of initial permeability. However, at pH 3 after a slow decrease, a significant increase is observed, to more than 40 % of initial permeability. The variation is alsi influenced by flow rate.

Key words: flow rate, pH, permeability, fine migration, formation damage, XRD, SEM-EDS.

GK4-4

Deducing Neotectonic Activities Using Geomorphological and Structural Features in Iraqi Kurdistan Region

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Abstract

Iraqi Kurdistan Region is located in the northeastern part of the Arabian Plate which is colliding with the Eurasian (Iranian) Plate. This collision, which is still active with convergent type of tectonic boundary has caused deformation of the rocks in the Zagros Foreland Basin with different intensities. The deformation intensity decreases southwest wards since the exerted stresses from the collision is in NE – SW direction. Depending on the deformation intensity and many other factors, the tectonic framework of the region which is part of the main tectonic frame of Iraq is divided into three main tectonic units among them only two units are within Kurdistan Region. The two zones are from NE – SW direction: 1) Shalair Terrane, and 2) Outer Platform. In the current study, many evidences about Neotectonic activities are presented from different parts of Kurdistan Region depending on different geomorphological and structural features. Among those features are: abnormal trends of valleys, dislocated and dissected alluvial fans, regional lineaments, water and wind gaps, faulted rocks of Pliocene – Pleistocene age, active faults. The Neotectonic evidences were recognized using satellite images and the existing Neotectonic data; some of them were checked in the field.

Keywords: Neotectonic; Water gap; Wind gap; Pleistocene faults; Dissected alluvial fan; active fault.

GK4-5

JOINT ANALYSIS OF KALOSH ANTICLINE, KURDISTAN REGION, NORTHEAST IRAQ

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Abstract

Joint analysis carried out throughout a traverses across Kalosh Anticline. The anticline is located about 30 km south of Sulaimaniyah city, Kurdistan region, NE Iraq. It extends NW-SE for about 17 km within the high folded zone of the northwestern segment of the Zagros Foreland Fold Thrust Belt. The aim of this work is for unraveling the tectonic history and detecting tectonic episodes responded for the initiation and development of the anticlinal structure. More than 400 joint planes were classified into sets and systems according to their relations with three mutually perpendicular geometric axes (tectonic axes). Tension sets are ac and bc, the first one formed by extension along fold axis accompanying direct compression perpendicular to fold trend, whereas the second is the product of relaxation that succeeded the primary compression. The shear systems are hk0, h0l and 0kl developed successively during direct compression and subsequent relaxation episodes of each tectonic force.

Field observations and paleostress analysis indicate that the area was subjected throughout its geological history to four stress phases. First is primary compressive tectonic phase in the directions NE-SW. The second compressive tectonic stress in the direction NW-SE considered as a secondary phase. Third was extension tectonic phase in the direction NE-SW which developed during the final uplift stage of folding is normal to the major fold trend. The fourth is NW-SE extension face considerate as extension stress related to the primary NE-SW compressive stress.

Key Words: Kalosh Anticline, Paleostress analysis, joint analysis.

GK4-7

Deducing the Lateral Growth of Handreen, Zozik and Tanoun Anticlines inIraqi Kurdistan Region Using Geomorphological Features

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Abstract

Handreen, Zozik and Tanoun are three major anticlines in the northern part of Iraqi Kurdistan Region located NE of Rawandouz town. All anticlines are oriented NW – SE with a steep southwestern limb. The length and width of Handreen, Zozik and Tanoun anticlines are: 20.2 km, 23 km, 27 km, and 10 km, 4.7 km and 2.5 km, respectively. The anticlines are separated by very narrow synclines. However, Tanoun anticline is thrusted over Zozik anticline causing the disappearance of the synclinal axis between the two folds. The oldest exposed rocks in Handreen anticline are the Cretaceous age, in Zozik anticline are the Upper Jurassic rocks, whereas in Tanoun anticline, the Lower Jurassic rocks are exposed. The carapace of Handreen and Zozik anticlines is built up by Bekhme and Qamchuqa Formations and that of Tanoun anticline by the Qamchuqa Formation. Satellite images and geological maps were used to recognize the geomorphological and structural features which were checked and confirmed in the field. It was found that Handreen, Zozik and Tanoun anticlines show clear geomorphological and structural features which indicate their lateral growth. Among those features are water gaps, wind gaps, forked-shaped valleys, curved valleys, inclined (curved) valleys, radial valleys, abandoned alluvial fans, wale-back shape, en-echelon folds and folds with malty domes.

Key words: Lateral growth; water and wind gaps; fork-shaped valleys; radial valleys, curved valleys.

GK4-8

Petroleum Generation History in Kurdista Region, Iraq: Insights from Burial History Reconstruction and Thermal Maturity Modeling

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Abstract

Five key source rock horizons at five locations in northern Mesopotamian Basin were selected for dimensional modeling utilizing PetroMod1D. Constructed burial-history locations from east to west in the region are: Taq Taq-1; Qara Chugh-2; Zab-1; Guwair-2; and Shaikhan-2 wells. The thickness of overburden over the main source rock of the area, Sargelu Formation in the central part of the south which is 2130m, suggest that the timing and extent of petroleum generation will become later and less toward northwest and west due to decrease of overburden thickness in the area and earlier and greater toward the east and southeast.

Termination of oil generation for Sargelu oil is at nearly 0.73 $\%R_o$, and for the other oil-prone source rocks it is between 1.12 and 1.18 $\%R_o$. The initial cracking of oil to gas for both source-rock types is between 1.67 and 1.77 $\%R_o$.

The Zab-1, Guwair-2, and Shaikhan-2 locations have the smallest potential for gas from oil cracking because oils from Sargelu source rock have not been cracked to gas yet. Generally, the order of increasing potentiality of the burial-history sites for gas generation from the cracking of oil is Shaikhan-2< Zab-1< Guwair-2 < Qara Chugh-2 < Taq Taq-1.

Key Words: Burial history, PetroMod, Taq Taq-1, Zab-1, Qara Chugh-2, Guwair-2, Shaikhan-2

GK4-9

Role of facies in shifting trends of anticlines: Examples from Zagros Fold-Thrust belt, Kurdistan Region, Northeastern Iraq

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Abstract

The Zagros Fold Thrust Belt elongate for more than 1500 kms from Oman to Turkey and path through Kurdistan Region, northern Iraq where the studied area is located. It has about 200 kilometers of width and the anticlines axes are trending between 300°-325° in the area. The present study focused on a local disturbance of the above trends in the Chwarta–Mawat area. The disturbance is expressed by 20-30° of clockwise rotation (toward north) of axes of the local anticlines relative to the non-rotated (general) trend of Zagros belt. The rotation occurs in the lateral boundary between the Early Cretaceous Balambo Formation (thin bedded limestone and marly limestone) and Qamchuqa Formation (massive limestone and dolomite). These two formations are consisting of incompetent and competent rocks respectively. The reasons for this tectonic disturbance is discussed and analyzed according to the direction of stress in the area and boundary conditions that are associated with rotation. The study attributes the disturbance to lateral facies change from competent, in the northwest, to incompetent rocks in the southeast. Furthermore, the facies change is associated with presence of massif block (Mawat Massif) which responsible for rotation and transmitting of the northeast Zagros tectonic force toward privileged direction (more softer rocks) of the incompetent rocks through the massif. The massif is a large block (26 km × 8 km) and according to previous studied consists of igneous and metamorphic rocks in addition to conglomerates. The block is located between rotated folds (the local disturbance) and the Main Zagros Thrust. Due to southwest pushing of the massif, the surrounded rocks are folded and aligned parallel to the massif. The rotated folds are localized at the interfaces of the massif and incompetent rocks. The record of this local disturbance is important for analysis of the dynamic evolution of Zagros since the local events can be used for interpretation of regional ones.

Keywords: Zagros orogenic belt, Zagros local deformation, Zagros transpression, Mawat area, Balambo Formation, Qamchuqa Formation

GK4-10

Petrology and Geochemistry of Gole Pillow Basalt in Penjween area Kurdistan Region- NE Iraq

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Abstract

The petrological, morphometric and geochemical analyses of pillow lava from Gole village (Penjween town) Sulaimani city Northeastern Iraq have been undertaken. The Gole Pillow basalt (GPB) extruded, in the form of pillow and sheet flow into the Qulqula radiolarite Formation. The basaltic intrusion restricted to a small area of about 100 m^2 within Penjween-Walash zone in the Zagros Suture Zone (ZSZ) of Iraq. The investigated area divided into two sections GPB1 and GPB2. It is envisaged that the studied area distinct two episodes of submarine alkaline eruptions that produced pillowed lavas that differently interacted with sea water to produce different morphologies and geochemistries. The pillows of the GPB1 section well exposed all along the Shalair river near Gole village. Although the pillows of the GPB2 section altered due to low-grade metamorphism and late hydrothermal processes, their igneous textures are still preserved. GPB samples are mostly phyric in nature and show porphyritic or sub-ophitic textures.

Petrographically, most of the GPB rock samples appeared as amygdaloidal and vesicular aphanitic basalt. Large phenocryst of hypersthene with schiller structure is present within a matrix of longer quenched plagioclase. Numerous small euhedral grains of opaque minerals like ilmenite and hematite are dispersed in the fine groundmass.

Morphological features show that the GPB appeared as spheroidal and lobate to tubular individual pillows. Although some pillow extends 2 meters with a foreset distribution some others show cracked with irregularly jointed surface and larger vesicles partly filled with calcite and quartz.

Geochemical investigation of GPB exhibit high TiO_2 (3.42 – 3.84 wt.%), Fe_2O_3 (14.84 – 19.93 wt.%), and high Zr/Nb and Zr/Y ratios respectively (5.85 – 7.2) (7.10-11.40). The content of alkalies, with the Nb/Y ratio≥1.4, and silica, as well as many trace element discrimination diagrams, classify the GPB as alkaline basalts.

The field, stratigraphic relationships, and geochemistry of the GPB and associated clastic and carbonate sediments suggest that the pillow lavas were emplaced in a shallow marine marginal within plate basin. The overall geochemistry of GPB resembles that of alkaline basalts generated in within-plate ocean island settings (OIB-type).

GK4-11

Geological study of Aqra Formation for possible use as Portland cement in Chwarta-Mawat area Sulaimani – Iraqi Kurdistan Region

Chro Mohammed Fatah, Kamal Haji Karim Ahmad and Tola Ahmad Mirza

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Abstract

A succession of highly fossiliferous limestone of Aqra Formation is studied geochemically and stratigraphically. The outcrops of succession have the thickness, width and length of about 160, 1500 and 30000 meters respectively. The outcrops located in the Chwarta-Mawat area in the Kurdistan Region, northeastern Iraq. An exposed section is selected for field and lab studies, during which inspection of the section by eyes and hand lenses conducted in addition to taking twelve samples which are geochemically analyzed for indication of possible use of the succession for Portland cement production. The analysis shows that the whole succession is consist of calcitic limestone which contain more than 95 % of $CaCO_3$, less than 1% MgO, Fe_2O_3, Al_2O_3 Na_2O, and K_2O. These percentages show that the limestone is high grade limestone which is very suitable for Portland cement production. In the area there is good quality and quantity of claystones as additive materials for the klinker. These claystones are belong to the unit one of the Red Bed Series which extensively exposed directly to the north and northeast of the outcrops of the Aqra Formation. For this purpose, this research studies focused on suitability of the Aqra limestone for cement industry in Kurdistan Region. The limestone and claystone samples are analyzed in Mass Cement Factory in Sulaimani city and School of Earth and Environmental Science, Washington State University for determining the percentages of chemical constituents like SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, SO_3, and loss on ignition (LOI). The results show that the Aqra limestone can be used in cement industry. The Ratios of the alumina modulus (AM), Hydraulic modulus (HM), silica modulus (SM) and lime saturation modulus (L.S.F) were also calculated. It was found that the ratios of some of these samples are compatible to Standards Specifications and other are not therefore some quantity of claystone from middle part of Red Bed Series were added to compensate for the percentage of silica, alumina and iron oxides for the suitable limestone as well as lowering the LSF values to acceptable ranges. It was found that most of the clinker phases of the studied samples have a good agreement with these typical constituents of normal Portland cement.

Keywords: Aqra Formation, Mawat area, Late Cretaceous carbonate, Portland cement, Chemical Composition, Clinker phases

GK4-12

Landslide susceptibility assessment along Biyara-Tawella road, Kurdistan region, NE-Iraq

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Abstract

Landslide hazard assessment is carried out for the slope failures along the 12km road-cut between Biyara-Tawella. The road is considered a very important road connecting Iraq-Kurdistan region with Iranian border, in the meantime, it is an important tourist route during summer and spring season. Slope stability assessments consist of twenty-four stations along the main road was done in the area of interest. A regional survey of slopes and a detailed discontinuity assessment was performed along the outcropped rock units represented by the highly deformed Qulqula Formation, quaternary clastic deposit, and some local body of pillow basalt. Different types of failures in the area were identified. Failure types along the cut slopes from most to least abundant are rockfall, wedge siding, and lateral detachments. Joint sets acted as lateral, back or composite back release surfaces during slope failure. The earthquake effect as a trigging mechanism of rockfalls leads to decreasing stability along the roadsides.

Different rock physical factors have been used and evaluated; the highly fractured properties of rocks, intense rainfall, and freeze-thaw cycles consider the main factors influencing the slope failure. The slopes were assessed by using landslide possibility index (LPI), it shows various geo-hazard categories that range between "moderate hazard" to "very high" LPI categories and “low” to “high” hazard categories. Kinematic analysis carried out for two sites only by using DIPS V6.008 and the results show wedge sliding at site No.22 and lateral detachment in site No.23, because of lack or limitaion of structural data at the other sites.

Rockfall hazard assessments system (RHRS) developed by the Oregon State Highway Division has drawn based on vehicle vulnerability and elements regarding the rockfall hazard. The analysis of twenty-four cross section of the cut slopes shows various unacceptable risk categories and it needs remedial works.

Keywords: Landslide possibility index, RHRS, Kinematic analysis, Kurdistan Region

GK4-15

Preparation of NanoSilica from Dunite Rocks

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Abstract

Nano-silica, one of the substances boosting the field of nano materials, can be produced by dissolving olivine in acid. The dissolution of olivine is a convenient alternative route to the existing methods of nano-silica production (neutralization of sodium silicate and flame hydrolysis) because the olivine dissolution is a low temperature process making this method cheaper and greener. Furthermore, this process can use waste olivine materials for the production of nano-silica. The produced nano-silica has a specific surface area 613 m2/g; a primary particle size 7 nm, which is agglomerated in clusters; and an SiO2 content above 98 wt.%.

Keyword: nanoslica, dunite rocks and extraction.

GK4-16

High – Resolution Biostratigraphic Analysis of K\Pg. Boundary, Bekhair Anticline, Duhok Area, Kurdistan Region of Iraq

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Abstract

A high resolution planktonic foraminiferal biostratigraphic analysis for the debatable K\Pg. boundary, Bekhair anticline, Duhok area, Kurdistan region of Iraq, reveal a complete biozones sequence across the boundary. Contact zone is represented by the upper part of Shiranish Formation (Latest Maastrichtian) and Aliji Formation (Danian). Results of this biostratigraphic investigations show that the K\Pg. boundary is located in a continuous interval of pelagic bluish-grey marl with a clay bed points the boundary and containing a thinly yellowish layer at bottom which marked the very biostratigraphic contact of Mesozoic/Cenozoic.

According to the stratigraphic distribution of the planktonic foraminiferal assemblages, three Cretaceous foraminiferal biozones, and four zones and three subzones of the Paleogene were recognized through the boundary transition. The sequence of these zones and their index species are as follow; Pseudoguembelina hariaensis Interval Rage Zone (Part); Pseudoguembelina palpebra Interval Range Zone; Plummerita hantkeninoides Total Range Zone; Guembelitria cretacea Partial Range Zone; Parvularugoglobigerina eugubina Total Range Zone; Parasubbotina pseudobulloides Interval Zone (Globanomalina archaeocompressa Partial Range Subzone, Subbotina triloculinoides Interval Subzone, Globanomalina compressa-Praemurica inconstans Interval Subzone); and Praemurica uncinata Interval Zone. This planktonic foraminiferal biozones sequence indicate that the Cretaceous – Paleogene boundary at the studied area is continuous with no hiatus.

Keywords: K\Pg.; Biostratigraphy; Shiranish; Aliji; Duhok; Kurdistan; Iraq.

GK4-17

Using gravity Data to subsurface Investigation of Al-Ma′aniyah depression in southwest Iraq

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Abstract

A primary use of gravity studies in both Petroleum and mineral exploration is the mapping of basement relief. The gravity data of Al-Ma′aniyah depression that derived from Iraqi GEOSURV. The separation residual from regional by using power spectrum technique. Enhance regional and residual gravity anomalies using first vertical derivative (FVD) and total horizontal derivative (THDR). Modeling and inversion gravity data by convert Bougure gravity map to stacked profiles map. A nineteen profiles lines (named L1 to L19) are taken to model the gravity field of the study area. Matching processing of all modeled lines are assumed by polygons represented the sedimentary cover. To get more clear figures about the modeled bodies, a 3D view is presented for the subsurface modeled structures in the study area. The inversion of gravity data show the basement depth about (7.5-10) km at Al-Ma′aniyah depression.

Key words: Al-Ma′aniyah depression, Forward and Inverse modeling, Basement depth estimation.

GK4-18

Organic geochemistry and petrography of the Cretaceous Sarmord Formation, Miran Oil Field, M-2 well, Kurdistan, NE Iraq: Implications for hydrocarbon generation potential and thermal maturation

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Abstract

The Lower Cretaceous Sarmord Formation (Hauterivian–Barremian) has been investigated in this study. The selected well is M-2 Well, which is one of the wells belonging to Miran Block, Sulaimani Governorate, Kurdistan Region of Iraq. The area of interest is situated in the High Folded Zone, Western Zagros Fold-Thrust Belt, being approximately 30 km far from Sulaimani City in the northwest direction. The selected samples were analyzed by Rock-Eval Pyrolysis and studied microscopically to determine the type of organic matter, level of thermal maturity, the hydrocarbon generation potentiality, as well as the palaeoenvironmental conditions of deposition.

Rock-Eval Pyrolysis data show that total organic carbon for Sarmord Formation is between 0.83 to 1.55, with an average value 1.27 wt.%. The average and range of S1, S2, and Genetic potential (S1+S2) are: 0.76 (0.55–1.09), mg HC/g Rock, 0.82 (0.65 – 1.28), mg HC/g rock, and 1.58 (1.21 -2.37), respectively. The hydrogen index (HI) is between 47 and 98, with an average of 66. Rock-Eval data indicate the dominance of Kerogen Types III and IV. The analyzed samples are thermally considered as immature (minimum and maximum T_{max} are 301 and 434 ^{o}C). The disagreement between relatively acceptable range of TOC wt.% in one hand, and poor potentiality, on the other hand, can be interpreted by the relatively high amount of residual carbon (RC%= 1.035) in comparison to pyrolyze carbon (PC%= 0.23). Therefore, Sarmord Formation contains a satisfiable range of organic matter, but the organic matter by itself has poor potential to generate hydrocarbons (low amount of S2).

Petrographic study proved approvedthat the samples mostly contain bituminite, which is disseminated predominantly within the clayey particles, with minor amounts of alginite. Additionally weathered and degraded humic particles, interpreted as a content of drilling mud. Frequent solid hydrocarbons were observed being associated with the clay-rich particles and less with the carbonates-rich particles. The equivalent vitrinite reflectance for the studied

section ranges between 0.73-0.81%, with the values close to 0.8% being more accurate as were measured in smooth surfaces. The obtained values indicate maturation within the oil window.

Based on the Infrared spectroscopy, all samples are belonging to type B and C, which are considered as gas-prone kerogen type. Regarding the thermal maturity, the examined samples fall between 0.8 to 1.1 of virinite reflectance equivalent grid. Thus, the state of thermal maturation for Sarmord Formation is considered late stages of oil window. This result coincides roughly with the results of vitrinite reflectance measurement (oil window) although point to slightly higher maturation level.

Keywords: Sarmord Formation, Kurdistan, Miran Field, Hydrocarbon potentiality, Kerogen type.

GK4-19

Stratigraphy and Ichnofacies of the Eocene – Oligocene boundary at Sinjar area, NW Iraq

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Abstract

The present study deals with the Lithostratigraphy, biostratigraphy and chronostratigraphy of the Eocene- Oligocene boundary in three surface sections in Sinjar anticline northwestern Iraq, in addition to study the trace fossils and related ichnofacies and geological history of this boundary at this location. Jaddala Formation which composed of marl and marly limestone represent deep Eocene facies, Palani and Tarjil formations represent Early and Middle Oligocene sequences . Sixty two planktonic foraminiferal species belonging to sixteen genera have been recognized which permits the recognition of four Zones, these are from older at the base:

4- Globorotalia opima opima Total- Range Zone (P21)

3- Globigerina ampliapertura partial- Range Zone (P20)

2- Pseudohastigerina micra Interval Zone (P 19)

1- Globigerinatheka subconglobata subconglobata Partial – Range Zone (P11) (Part).

The Eocene- Oligocene boundary in Sinjar area represent disconformity surface, where the deposition ceased in the Middle Eocene at the end of Jaddala Formation, forming the firmground Glossifungites Ichnofacies which embrace Thalassinoides ichnotaxa in Jaddala section, and the hardground Trypanites Ichnofacies in Sharaf al-din section. The Sinjar section represent the more deep place so the lag conglomerate bed which exist at the lower part of Palani Formation in Jaddala section did not reach this area, instead a chalky limestone bed deposited at the Early Oligocene representing Skolithos Ichnofacies.

A rapid wide transgression took place at the Upper Early Oligocene leading to the deposition of Tarjil Formation which consist of thinly laminated hard white-pale brown intercalation of marly limestone and marl beds.

GK4-20

Iron Mineralization in Iranian Kurdistan Province: Characteristics and Mineralization Origin

(POSTER)

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Abstract

Iranian Kurdistan province is located in the northwest of Sanandaj-Sirjan metallogenic zone(SSZ). This zone is bordered by Urumieh-Dokhtar magmatic arc and Zagros Thrust which is the boundary between the Arabian and Iranian plates. In Iranian Kurdistan, SSZ geologically is dominated by the Triassic and Jurassic sedimentary sequence occasionally associated with volcanic rocks. At the late Jurassic, the sediments were folded and weakly metamorphosed by the late Cimmerian phase. A chain of calc-alkaline intrusive masses includes diorite, quartz diorite to granodiorite and granite are injected into the zone in late Jurassic and Cretaceous, thereby increasing the geothermal gradients and metamorphic zone around the intrusive masses. The Triassic-Jurassic sedimentary rocks were affected by the Laramide orogeny at late Cretaceous which resulted in formation of metamorphic units. Also a range of calk-alcaline intrusive masses include gabbro, diorite and granite are injected in the Zagros Thrust Zone at the late Eocene-lower Oligocene. SSZ is very important in terms of iron, manganese and gold mineralization. Our review of the iron mineralization in Iranian Kurdistan province indicate a two phase formation process of low and high temperature paragenesis for more iron mineralizations in the region as follows: in the first phase, the sedimentary of iron oxides are formed in the volcano-sedimentary layers and in the second phase, after a period of orogenese, metamorphism and plutonism, high temperature fluids released from solidification of profound plutonic body dissolve iron oxides of the first phase (hematite) and cause recrystallization of these elements in shallow levels as magnetite accompagned by high temperature silicates veins(skarn).

Keywords: Mineralization, Kurdistan province, Sanandaj-Sirjan zone

GK4-21

The use of potential data to evaluate the tectonic setting of the Western Desert, Iraq

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Abstract

This study aims to study the geological structures that affecting the formation of karstic Bauxite and Iron deposits using potential data in the selected region of the Iraqi Western Desert. To achieve this, The CET (Centre for Exploration Targeting) Grid Analysis extension was applied to aeromagnetic and gravity data and It is supposed that the provided results are unbiased. Decompensative anomaly map of an isostatic residual gravity anomaly map shows NNE maxima trend in the eastern part of the study area, while the western part shows NE minima, where this gravity low is thought to be an important basin uplifted later to form Horan Anticlinorium. The reduced to the pole magnetic map, in general, agrees with the gravity interpretation, however, there are some differences related to the magnetic susceptibility variations within the basement. Four sets of lineaments were determined using the CET grid and derivative analysis. These lineaments are thought to be related to the formation of the karstic ore deposits in the Western Desert.

GK4-22

MICROGRAVITY SURVEY FOR OUTLINING WEAKNESS ZONES IN KIRKUK SILO, NE IRAQ

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Abstract

A microgravity survey was carried out in Kirkuk Silo, 12km SW Kirkuk city and 260km N Baghdad. This study aims to outline the locations, depth and extensions of subsurface weakness zones produced by near surface groundwater impact. A total of 1171 microgravity point were measured. The points are distributed on 67 traverses ranging in length between 90m to 320m with a 5m spacing interval between every two adjacent points. The range of the microgravity readings is 96 µGal.

The results were displayed as Bouguer anomaly map, regional and residual maps and profiles to show the distribution of negative anomalies that related to subsurface weakness zones. The depths of these anomalies were calculated by using power spectrum analysis and 2D forward modeling that showed three mean depth levels; 2.16m, 5-6m (shows the main effect) and 12m. Moreover, a map of near surface groundwater flow directions was produced utilizing the distribution of the negative anomalies and the general trend of slope direction in the study area.

It is concluded that the groundwater activity, which depends on the amount of surface water that percolates through the upper part of the ground surface, in the study area should have a direct relationship with the discharge rate. A high discharge rate increases the impact and accelerates the evolution of weakness zones. However, groundwater discharge should be stopped before any treatment occurs in the study area. Putting pile sheets around the Silo is suggested for stopping the near surface groundwater drainage.

Keywords: groundwater impact, microgravity survey, near surface weakness zones, Iraq

GK4-24

Assessment of Avroman limestone Formation for Portland cement industry, Halabja city, Kurdistan Region NE-Iraq

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Abstract

Limestone is the main constituent as raw material used in manufacturing of cement. This study the limestone deposits from Avroman formation were evaluated for its suitability to be used as raw material for cement industry through chemically and mineralogical techniques. The 21 handpicked samples of limestone were collected from different geological beds of Avroman formation; these samples were investigated through Petrographic study using x-ray diffraction XRD, x-ray fluorescence XRF, physical test and mechanical test. Geological review shows that there is a good potential for industrial grad limestone , the petrographical study as well as mineralogical analysis indicate that the limestone samples was crystalline and dominantly consist of calcite. The major clay minerals in the clay samples are chlorite, illite, montmorillonite and the kaolinite appears as a minor clay mineral. The geochemical analysis indicates that the limestone from Avroman formation shows a wide range of CaO(46.13-56.00), Al_2O_3 (0.01-0.86), SiO_2(0.00-1.51), MgO(0.24-0.71), K_2O, Na_2O, TiO_2 and MnO are present in traces the chemical composition of Avroman Limestone Formation reflects mineralogical composition and physical properties, (water absorption and moisture content) show that the dry process is preferred for manufacturing of Portland cement, the mechanical properties especially compressive strength show that the quarried and crushed can be easily during manufacturing.
From the results of analysis, it is concluded that the limestone of this formation and clay material of the study area is of good quality and can fulfills the international standards of Portlandcement.

Keyword: Avroman Limestone, Physical properties, Mechanical properties

GK4-25

LiDAR; A New Era in Geospatial Technology

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Abstact

Lidar Instruments **Emits** intense, focused beams of **Light** and measures the time it takes for the reflections to be **Detected** by the sensor. It can rapidly measure the Earth's Surface, at sampling rates greater than**150,000** pulses per second. The resulting product is a densely spaced network of highly accurate Georeferenced Elevation Points often called a **point cloud**, that can be used to generate Three-Dimensional Representations of the Earth's Surface and its features.

The Aims of the present study are to explores the potential for using LiDAR Data in different Earth Resources disciplines.

To fulfill these Objectives, LiDAR data covering Two localities within Sulaimani Governorate were selected as Case Studies. These localities are; **Sulaimania Town** and **Peramagroon area** nearby.

LiDAR Data, including: **dem, bare dem, cir. and intensity** data types that covred the Two Localities, where manipulated, processed and interpreted in a GIS Platform using ArcMap 10.4.1 Software.

Currently, LiDAR Data are applied in hundreds of diciplines. For the purposes of the present study, three disciplines were tackled in this context including; Topographic & Terain Analysis, Hydrologic Aspects and Urban & City Planning.

The results achieved compised maps of Hydrologic Characteristics, such as: **Drange Network, Watershed, DEM, Bare DEM, Streams Flow Directions and Water Accumulations**.

In the domain of Topography and Terain Analysis, **3D Maps and Hillshade Models**, were obtained. Concerning the Urban & City Planning, the result maps include: **the Bare DEM Contour Maps**, **3D City Maps** and other **Utility Maps**.

During the presnt study,the LiDAR Data, were compared with other Classical Remote Sensing Data; such as, High Resolution DigitalGlobe Images covering the two localities to verify the Competence of high efficiency of the LiDAR Data compared with the others.

In conclusion, the study revealed the high potential of the LiDAR Data with respect to the Accuracy, Acquisition and Cost Effective, which is definitely opened new **Era in the Geospatial World.**

GK4-26

Landscape expressions of tectonics in the Zagros fold-and-thrust belt (POSTER)

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Abstract

We used geomorphic indices including normalized channel steepness index (k_{sn}), relief and hypsometric index (HI) to investigate how landscape responds to tectonic and climatic drivers in the Zagros fold-and-thrust belt. There is a broad association of relatively higher k_{sn} values (>50 $m^{0.9}$) with the upper elevation limit for seismogenic thrusting, which occurs regionally at the 1250 m topographic contour. Relatively high k_{sn} values occur beyond this seismicity cut-off in the Bakhtyari Culmination, but are rare in the Fars region. HI were measured for 17380 third order river basins across the Zagros. In many areas the low/high HI transition (0.3) is typically at the elevation limit of seismogenic thrusting. There are two important exceptions. In the Dezful Embayment/Bakhtyari Culmination the low/high HI transition lies northeast of, and at higher elevations than the thrust seismicity cut-off. In the Fars region, the HI transition lies south of the seismicity cut-off. We explain these differences by the different climates of the two areas: wetter conditions and vigorous drainage systems in the Dezful/Bakhtyari region retard orogenic plateau growth; drier climate and low power rivers in the Fars region promote plateau growth. Orographic precipitation may itself have a tectonic control; regional basement strength variations have caused intense thrusting and high relief in the Bakhtyari Culmination. Integrated relief along different swath profiles across the Zagros is in the range 2.2 – 2.8 10^8 m^2. We argue that this consistency relates to the comparable strain rates across different sectors of the Zagros, regardless of local structural, drainage network or climatic variations.

GK4-28

Petroleum modelling in the Laminaria High, Bonaparte Basin, North West Shelf of Australia: Influence of critical stressed faults on hydrocarbon migration and leakage.

(POSTER)

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Abstract

Geophysical and geological evidences for hydrocarbon leakage associated with active faults on the Laminaria High, North West Shelf of Australia includes: 1) the presence of amplitude anomalies associated with the traces of faults that cut and displace the seabed reflector; and 2) the presence of residual hydrocarbons in dry, fault- bounded traps. Modelling of hydrocarbon migration is essential for risk assessment in areas that show hydrocarbon leakage. Further understanding and modelling of the geological structures and reservoir properties that are associated with known leakage will increase the confidence of successful drilling. In addition, it helps to understand the possible reasons that lead to hydrocarbon leakage in these areas. We use Permedia software to model the possible secondary petroleum migration along a seismic reflection dip-line that crosses the area of interest. The models are used to investigate how the source rock properties and petrophysical characteristics of the sequence lithofacies influence the secondary migration. As there are large uncertainties associated with the entry pressures assigned to mapped faults, we start with the hypothesis that critically stress faults (identified based on their orientations and knowledge of the regional stress tensor) have lower entry pressures than other faults. We found that hydrocarbon migration is controlled by two major faults: 1) fault with strike direction NE dipping to the north; and 2) fault with strike direction NE dipping to the south. Hydrocarbons are more likely to migrate along faults in the southern part and less likely to migrate along faults in the northern part of the survey area. This is because the larger fault dipping to south has a larger slip tendency than the larger fault dipping to north; hence it will be more likely to leak. We conclude that vertical migration is controlled by faults that are critically stressed at the present day. These results are consistent with the geophysical evidence of hydrocarbon leakage at the seabed in the southern part.

GK4-30

Regional factors controlling the type of Pliocene deposits in the Southeastern Caspian Basin, NE Iran

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Abstract

In the present research, the Pliocene Cheleken and Akchagyl formations, as the most important reservoir intervals in the Caspian basin of Iran and other adjacent countries, were investigated from the point of view of facies changes and their controlling factors. This work was done on the basis of field observations, petrographic studies and 2D seismic interpretations.

These studies focused on three of the thickest surface sections (located in the Gorgan-Gonbad plains) and ten exploration wells. Interpretation of facies and correlating them along the surface/ subsurface sections clearly illustrate the changes in thickness and type of facies in the study area. Accordingly, the lower to middle Pliocene Cheleken Formation with dominant clastic facies has been deposited during sea level falling and rapid subsidence resulted from the uplift and erosion of the Alborz and Kopet Dagh Orogens. In contrast, the upper part of Pliocene Akchagyl Formation (with dominant carbonate facies) records a major regional transgression, and reconnection of the study area to the global oceans. This event was confirmed by the presence of marine biota and flat geometry pattern of the sedimentary basin. Discrepancies between these two conditions can be interpreted by changes happened in sediment supply and subsequent subsidence in the basin during the Pliocene.

Keywords: Facies, Pliocene deposits, Southeastern Caspian Basin, NE Iran

GK4-31

Linking diagenesis to sequence stratigraphy and its impact on reservoir quality of the Asmari Formation in Naft Safid field, Dezful Embayment

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Abstract

The present study has investigated relationship between diagenesis and sequence stratigraphy along with their effects on reservoir quality of the sedimentary microfacies. Detailed Microscopy observations of thin sections from core/cutting-bearing wells led to identification of fourteen microfacies, which are classified into three sub-environments of Inner ramp (tidal flat, lagoon), Middle ramp and Outer ramp. Inner ramp microfacies mostly observed in upper and middle parts of the Asmari Formation, while middle to outer ramp microfacies largely developed in middle part. The most important diagenetic processes controlling reservoir quality of the Asmari formation include neomorphism, compaction, cementation, dolomitization, dissolution and fracturing. Transgressive system tract (TST) microfacies in middle to outer ramp have been subjected to neomorphism, compaction, dissolution (moldic porosity) cementation and partly dolomitization. Based on petrophysical data with considering diagenetic imprints, seven reservoir zones are proposed for the Asmari Fromation. Highstand system tract (HST) microfacies of inner ramp dominating the most part of reservoir zone 1 have been subjected to dolomitization, fracturing, minor compaction, and have better reservoir quality than the TST microfacies. Finally, correlation of the identified reservoirs zones has been investigated in the framework of third order stratigraphic sequences.

Keywords: Diagenesis, reservoir quality, sequence stratigraphy, Asmari Formation, Naft Safid field, Dezful Embayment

GK4-32

Source Rock Evaluation and Palynofacies Analysis of The Sargelu and Naokelekan Formations (Middle-Upper Jurassic), From Selected Areas, Northeast of Iraq

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Abstract

The sedimentary organic rocks of Jurassic Period are widely distributed in northeast Iraq. Two sections have been studied, a subsurface section in Taq Taq-1 oil well (Northern Oil Company) and another one surface section in Sordash anticline (Sulaymaniyah governorate). The aim of the present study was to combine Rock-Eval pyrolysis and palynofacies analysis in an integrated approach to study source rock samples of Sargelu and Naokelekan Formations (Middle-Upper Jurassic), which are the major petroleum source rocks in Iraq.

The organic geochemical analysis, total organic carbon (TOC) and Rock-Eval pyrolysis for 23 samples, as well as palynofacies analysis for 34 samples have been collected of the studied sections to the evaluate quantitatively and qualitatively, the nature of sedimentary organic matter, generation potential and assessing thermal maturity in each of the studied Formations.

Analysis data indicate that the Sargelu Formation was good source rocks samples and kerogen with organic matters was mostly show type III (Gas), as well as the amorphous organic matter (AOM) indicate specified the AOM types in Sargelu Formation was mostly shown are types B, C and B-D which reflects mature stage (Gas-Oil prone).

On the other hand the source rock samples of the Naokelekan Formation can be considered good-very good and kerogen with organic matters was mostly show type III-II (Gas-Oil mixed), as well as the amorphous organic matter (AOM) indicate specified the AOM types in Naokelekan Formation was mostly shown are types C, B and A, which reflects mature to overmature stage (Gas-Oil prone).

Key words: Organic geochemistry, Sargelu and Naokelekan Formations, Jurassic Period, palynofacies analysis, Northern Iraq.

GK4-33

Flood hazard Estimation in a selected region eastern Iraq using remote sensing and GIS

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Abstract

This work aims to estimate (1) the arid areas that cover by seasonal flood, and (2) the volume of the water, which covers the Badra Basin. Two types of data were used, which are Sentinel 2 and Alos-PalSAR. Two sets of Sentinel-2 have been analyzed. the first one acquired on April 04, 2019 and the second one acquired on August 27, 2018. We used these two sets to estimate the areas covered by flood-water. The Normalized Difference Water Index (NDWI) were applied for both sentinel-2 periods. We used the DEM extracted from Alos-PalSAR to determine the elevation of the shoreline. The Badra Basin is located between Iraq and Iran, within the Zagros orogenic belt, which is characterized by the Mesopotamia Foredeep (MF) and Low Folded Zone (LFZ). In addition to the watershed, we extracted the drainage network and the stream order for each valley. The watershed covers about 16,666 km^2, while the stream order reached to order-ten depends on Strahler stream order classification.

In Badra Basin, the flash flood is a recurrent natural hazard that causes damage to property almost every year, where the last one happened in April 2019. Naturally, the flood-prone areas are located around the main streams and the low lands in the south of the basin.

GK4-34

Distribution pattern of heavy minerals assemblages in recent sediments of Lesser Zab River Basin (LZRB), NE Iraq

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Abstract

Heavy minerals assemblage in recent sediments of the Lesser Zab River Basin (LZRB) has been studied to determine their content, assemblages' pattern groups, distribution manner spatial variability, and provenance. Morphology of selected heavy minerals was also recognized using Scanning Electronic Microscope (SEM). SEM analysis of heavy minerals grains is useful to identify surface textures of grains, which contributes to increasing knowledge of the grain's provenance. In addition, it's provided information about the weathering and erosion process that left in impact on the grain surface. Understanding the distribution pattern of heavy minerals in river sediment is necessary for the interpretation of the potential provenance and controlling factors. We analyzed twenty-four sediment samples for heavy mineral assemblage determination. We collected eight river sediments samples from the main course of the LZRB and sixteen samples from the outlet of its subbasins. Heavy minerals were separated for the size of 63–250 µm size fractions using bromoform. The polarizing microscope was used to identify and calculate the percentages of various types of heavy minerals. Grains morphology for selected heavy minerals were determined using Scanning Electron Microscopy (SEM). The heavy minerals suite recognized in the studied stream sediments includes; opaques such as (magnetite, ilmenite, hematite, and goethite) and non-opaque represented by amphiboles suite (hornblende, tremolite-actinolite), pyroxenes, epidotes suite (zircon, tourmaline, rutile, garnet, staurolite, kyanite), and flaky minerals suite such as (muscovite, chlorite, biotite, phlogopite). As None-opaque minerals assemblages provide valuable information about the provenance of sediments, therefore it takes more attention than opaque minerals in this research. The studied sediments consider immature, where it's characterized by the lowest concentration of ultrastable compared to unstable heavy minerals.

Keywords: Heavy minerals assemblage; Provenance; SEM; grains morphology; LZRB

GK4-35

Sequence stratigraphic investigation of the Early Miocene Formations in the Zagros Folded belt using wireline well logs analysis

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Abstract

Based on the available core sample description and wireline log analysis, sedimentary facies, microfacies and lithofacies interpretation are evaluated to determine the large scale architecture in the Early Miocene Formations, from close to the contemporaneous Lower Miocene depositional margin of the Zagros Basin, as represented in outcrop, to subsurface equivalents ca. 100 km to the south-west and west. Sequence stratigraphic methods of sedimentary log interpretation and log correlation are used to construct a model of the overall regressive or transgressive or combined transgressive to regressive character of each of the Formations, thus providing an indication of the gross reservoir stacking patterns over this distance. Based on outcrop descriptions and wireline log data the Dhiban Formation is interpreted as a lowstand system tract (LST) of a third order sequence, lying between the Euphrates Formation regressive parasequence set that could represent a highstand systems tract (HST) of a third order sequence and the transgressive parasequence set (third order transgressive systems tract, TST) of the lower part of the Jeribe Formation.

Several higher odder transgressive and regressive cycles are evident within the Dhiban Formation in the subsurface sections. The transgressive cycles within the Dhiban formation are associated with the carbonate layers. Yellowish grey, friable anhydrite is recognized in the Dhiban Formation at outcrop, and thick anhydrite of high gamma ray and low density readings was identified in the subsurface sections. This a lowstand evaporite system filling the basin centre can be confirmed as the relevant model for the mixed carbonate-evaporite basin at the scale of a third order cycle.

GK4-36

Organic geochemical characterization of crude oils from Cretaceous reservoir rocks in Khabbaz Oil field, Kirkuk, Northern Iraq

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Abstract

Six crude oil samples from different wells in Khabbaz Oil Field were analyzed using GC-MS. One of the samples was from lower Qamchuqa reservoir and the rest of samples were from the Upper Qamchuqa reservoir. Biomarker distribution and characteristics are used to provide information on source organic matter input, depositional conditions and maturation level. The n-alkanes, terpanes, steranes, and aromatic compounds have been monitored through using specified mass/charge ratios. The crude oils from Khabbaz Oil Field are not affected by biodegradation as it is revealed from the gas chromatogram shapes of the studied samples. Another point support this conclusion is the high ratio of saturated and aromatic hydrocarbons than the NSO components. All samples reveal the dominant of short chain n-alkanes between C_{15}-C_{18}, with isoprenoids pristine (Pr) and phytane (Ph). The unimodal envelope chromatograms, maximum peak carbon n-C_{15}-n-C_{20}, and low CPI values (0.89-0.93) indicated that organisms derived from phytoplankton, zooplankton and benthic bacteria with no photosynthetic and terrestrial plants. In the studied oil samples of Khabbaz Oil field phytane has relatively higher concentrations than pristane with low Pr/Ph ratios in range 0.6-0.73. This indicates that these oils were generated from organic matter deposited in a marine environment under reducing conditions. In most samples, the abundance of C_{32} homohopanes is moderate and the 22S/22R + 22S epimerization ratio is around 0.55 to 0.61. In addition, gammacerane was recorded in the analyzed samples and the gammacerane index (gammacerane/C_{30} hopane) was in the range of 0.01–0.12. The relative C_{30}hopane abundance is less than C_{29} norhopane in all samples with high C_{29}/C_{30} 17α (H) hopane ratios in the range 1.33 -1.62 which indicates that such crude oils are derived from carbonate –rich source rock. 20S/(20S+20R) and ββ/(ββ+αα) C_{29} sterane ratios were relatively consistent for all the analyzed samples, ranging between 0.43-0.46 and 0.58-0.63, respectively. This ratio (DBT/Phe) is also used to draw with Pr/Ph ratio as cross-plot, which is clearly indicates that

the oils were generated from marine carbonate source rock. The Khabbaz crude oils have a 20S/ (20S +20R) and ββ/(ββ+αα) C_{29} sterane ratios in the range 0.43 to 0.46 and 0.58–0.63, respectively, which indicate thermal maturity (equivalent to peak oil generation onset). The studied area is underlain by several rock units which may be the source rock of the Khabbaz Oils, such as Sargelu, Naokelekan, Barsarin, and Chia Gara formations.

Key words: Qamchuqa, Reservoir, Khabbaz Oil field, Kirkuk, Hopane, Sterane, Carbon isotope

GK4-38

VSP data processing and use on drilling trajectory control

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Abstract

Geophysical methods can be used for different purposes. Seismic methods have been used extensively in oil and gas explorations and cause better understanding of subsurface structures. Vertical Seismic Profile method with accuracy, lateral high resolution, and Limited to the around of well has effective aid on drilling operations. In this research, the usage of VSP method on one of Gachsaran field's wells is investigated. The results show that six faults are in trajectory and cross-cutting the well; except fault number 1, other faults have similar trends. Due to the complex geology of the field and several faults, deflection in direction of correct drilling trajectory is possible. This method has effective aid to identify correct drilling direction by finding correct reservoir formation.

Key Words: Geophysics seismic, VSP, Drilling trajectory, Gachsaran field

GK4-39

Twin-tectonic stress phases inferred From Fault –Slip analysis in Sartaki Bamo area, Zagros Fold Thrust Belt, Kurdistan Region of Iraq

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Abstract

Sartaki-Bamo area located in the northeastern part of Iraq at the Iraq–Iran border; and it is one of the most seismically active areas nowadays. Structurally, is a part of double plunging anticlinal structure with north-south trending axis, this gives abnormal structural deflection from other fold trends in the Zagros fold - thrust belt. Different types of major faults distributed within this area either in form of reverse or dextral strike –slip faults. Data were collected from nine major faults; five of them are reverse type, while the other four are strike-slip type. Synoptic fault-slip analysis for overall nine major faults, using two methods of analyzing (R. Dihedron and R. Optimum) was done and the result indicates that the maximum principle stress axis acts from the direction N49°E. When the Faults are segregated in to two groups, five reverse faults and four strike-slip faults, the data analysis from the reverse Faults indicates that the major stress which forming these faults are from the direction of (N90°E, i.e. nearly E-W). While analysis of the strike-slip faults shows the maximum principle stress direction are acted from the direction of (N25°E, i.e. nearly NNE-SSW). Tectonic Model for stress distribution within the area are constructed, the model indicates that Major Stress formed due to Collision between Arabian with Iranian plates are active from the direction (N49°E) , this stress resolved in to two components, one is perpendicular to the boundary which is in E-W (N 90° E) direction while the second one is parallel to the boundary that is NNE (N25° E) direction .The first one is responsible for formation of reverse faults, while the second one forming the strike-slip faults(Oblique faults).The above two direction of the stress are responsible in creating transpressional tectonic environment in the area, which interpret the formation of the most oblique displacements along the fault planes in the studied area as well as in the all Zagros fold and thrust belt. The resolving of the stress into two components may have an important role in becoming this area as a one of the highly and frequently earthquake activity swarms region within the Zagros fold and thrust belt.

GK4-40

Geochemical characterisation of shale filling stylolites and migrated oil in the Kometan Formation, Dokan, Kurdistan Region

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Abstract

Geochemical investigation of shale fillings along stylolite surfaces including oil stained shales and petroleum migration from the Kometan Formation was performed and samples were collected in two sections (Lower and Upper Dokan) and analysed by Gas Chromatography-Mass Spectrometry. Rock samples contain solvent extractable organic matter (EOM) and biomarkers having comparatively similar characteristics. The oil samples display identical characteristics apart from n-alkane distribution. The n-alkane distribution of the shale samples exhibit similar pattern dominated by even-over-odd n-alkanes indicating marine organic matter deposited under highly reduced water bottom conditions. The depositional environment is marine carbonate and confirmed by the relative abundances of tricyclic terpanes, hopanes, and regular steranes compounds. Within the environment, water column has been stratified for a certain period during deposition with some abundance of sulfur, most probably within a confined (slightly restricted) environment. The rock extracts have potential for hydrocarbon generation and have reached early to peak maturity levels. One shale sample exhibit some oil staining, which could be seen in hand specimen and it is illustrated in the biosignatures, and low level biodegradation in the Lower Dokan. The n-alkane distribution of oil samples was different as one sample lacks alkanes and the other preserved long chain alkanes due to different biodegradation extent. The degree of biodegradation was the least within the oil-stained shale sample followed by a moderate to heavy degree in the LDO sample and severe biodegradation in the LDSO sample. The oil samples possess characteristics that display evidence for multiple phases of petroleum migration: early phase of severely biodegraded and late phase of moderately-heavily biodegraded oil.

GK4-42

Vulnerability and Risk intensity map for multi aquifer units with sparse data availability: a case study from Bazian area, Iraqi Kurdistan Region

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Abstract

Vulnerability and risk assessment to specify areas that are more susceptible to pollution from a manmade source has become an important element for sensible managements of land use planning and to protect groundwater reserves from contaminations. A (DRASTIC) system is one of the most widely used models for groundwater vulnerability assessment. However, this model should be modified based on the local hydrogeological conditions in order to get a relatively accurate result. The current work presents hazard and risk assessments for Bazian area within the Sulaimani city. The vulnerability map of groundwater from multiple aquifer systems such as karstic-fissured, alluvium, and complex was created using the modified DRASTIC model based on pesticide DRASTIC index. Validation of the model results using 116 NO_3-N concentration samples obtained from wells and springs of the study area indicating that the resulting map is applicable for improving the modified model. Pearson correlation factor and R square relation between DRASTIC index and nitrate concentration results for both generic and Pesticide DRASTIC are (0.63, 0.7) and (0.69, 0.76) respectively. This result confirmed that the intrinsic vulnerability based on Pesticide DRASTIC method is more applicable than generic DRASTIC method.

Vulnerability Pesticide DRASTIC index with the hazard map was combining for producing risk intensity map (RIM) based on European approach method (COST Action 620). The Hazard map included twenty-six hazard feature types of the point, line, and polygon. Their distributions, extents and harmfulness degrees vary sharply from one place to another. Comparing the results of both RIM and pesticide DRASTIC index shows that the ranking of classes is changed. In intrinsic vulnerability, the class level ranking is (high, moderate, low, no or very low and very high), while Risk intensity class level ranking was (no or very low, low, moderate, very high and high) sequentially. This improved the importance of local study and the importance of combing hazard map with intrinsic vulnerability process for assessing actual aquifer vulnerability and groundwater pollution risk assessment and achieving relatively accurate results. Results of the risk intensity map divided the area into five classes, fortunately, the majority of the studied area shows no or very low and low of risk level respectively, while high and moderate risk level occupied small portions of the area of interest.

Keywords: Risk assessment, Pesticide DRASTIC, COST Action 620, Karst aquifer, Intergranular aquifer

GK4-43

Mineralogical Study of Kidney Stone in Fallujah City, Western Iraq

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Abstract

The current study is concerned with the mineralogical aspects of kidney stones from urolithiasis patients of different ages and genders in Fallujah city hospital. To investigate the mineralogical aspects of the studied samples, the following techniques were implemented as follows; X - ray diffraction (XRD) used to recognize the mineral components of the studied kidney stones, Infrared Spectroscopy (IR) to discover the type of chemical compounds of the studied kidney stones, Scanning Electron Microscopy (SEM) with Energy Dispersive X-Ray Analysis (EDX) to determine the minerology and the various chemical components in the kidney stones. The results show that the kidney stones are composed of six mineral groups and these are; calcium oxalate, magnesium ammonium phosphate, magnesium hydrogen phosphate, uric acid, tricalcium phosphate, calcium hydrogen phosphate and cholesten. The cholesten has been diagnosed for the first time in Iraq, which might be linked to the diet type that includes high levels of cholesterol. Furthermore, the most common mineral group in the study area is the mixed stone which occurs in males more than females for the ages of 40 to 50 years old.

Key words: Urolithiasis, Renal stones, XRD, IR, SEM-EDX, Cholesten.

GK4-44

Interrelationship between petrography and diagenesis in limestone: A case study of the Avanah Formation in north Iraq, Kurdistan

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Abstract

The exposed limestones of Avanah Formation in Kurdistan, north Iraq, were studied in three outcrops. Detailed field description was combined with thin section study to define the interrelationships between petrography and diagenesis in these limestones. A key to interpreting the relationships among the various petrographic components and diagenetic processes in the limestones, is the identification of substantial carbonate grains and those diagenetic processes that affected them. Petrographic analysis of the limestone of Avanah Formation revealed that the early-diagenetic processes such as micritization, early cementation, neomorphism and dissolution have a direct effect on modification of skeletal grains, whereas the late-daigenetic processes included a compaction, late calcite cementation, dolomitization, silicification, and stylolitization have effected directly on non-skeletal grains and groundmass. Petrographic analysis is also revealed that the cementation and dolomitization which are filling voids and fractures depends highly on a microstructures of the grains and on the presence of calcite and dolomite minerals within grains and groundmass of the limestone. In all of these cases, the petrographic characteristics of limestone grains are commonly associated with a burial depth and/or mineralogy of the host rock. Based on the petrographic characteristics and the diagenetic features of the limestones of Avanah Formation, the interrelationship between petrography and diagenesis seems to be strong.

Keywords: Limestone, Petrography, Diagenesis, Avanah Formation, Kurdistan, Iraq

GK4-45

The possibility of manufacturing of hollow clay block masonry wallet from claystone of Injana Formation, Takya area- Sulaimani City, Iraq Kurdistan Region

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Abstract

The hollow clay blocks are one of the main components of historic and contemporary construction technology that is employed not only over the whole Kurdistan but also in Iraq and other Mediterranean countries. The principle purpose of the perforations (making holes) is to increase the thermal insulation properties.

In this study, the claystone of Injana formation from Takya area was selected to evaluate their suitability for being used in manufacturing hollow clay block. The geotechnical properties of the hollow clay block (s) are assessed. To carry out this assessment, the chemical and physical properties of raw materials used in manufacturing hollow blocks were studied. The (claystone and sandstone) had been mixed after well- crushing to less than 1 mm size particles. Mixing ratio was made from claystone and sandstone for about 90 and 10% with 15 % water. 75 hollow clay blocks prepared with dimensions 400-200-200 mm and molded under pressure (22 bars) each blocks weighted about 19.600 kg.

The results of chemical analysis of these calystone show that the average of main refractory component SiO2 and Al2O3 are 47.593 wt. % and 15.147 wt. % respectively with some impurities such as MgO, Fe2O3, CaO and K2O. The averages of plastic limit, liquid limit, and plasticity index are 17.55 %, 32%, and 14. 46 % respectively and the studied samples were classified as moderated plasticity. The results of shrinkage limits percentage after firing for the studied specimens are 4.32 % and are lower than the mean values (5.75%) that show their suitability for manufacturing clay blocks.

The obtained results of geotechnical properties namely physical and mechanical properties compared to Saudi standard specification (SASO) No. 184/1980) for hollow blocks from burnt clay for wall and show that the Injana claystone can be used for manufacturing the hollow clay blocks.

Keywords: Hollow clay block, Physical properties, Mechanical properties

GK4-46

Petrography and Diagenetic history of Kometan Formation (Upper Turonian-Lower Campanian) in the Kometan Village, Imbricated Zone, Iraqi Kurdistan Region

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Abstract

The petrography and diagenetic history of Kometan Formation (Upper Turonian- Lower Campanian) is studied from its type locality outcrop in Kometan Village, Imbricated Zone, North eastern Iraqi Kurdistan Region. Lithologically the formation consists of 44 m of white weathered, light grey, thin to medium bedded highly fractured limestones with chert nodules and rare lenses in the upper part. The petrographic studies of formation are based on 55 thin sections and showed; the majority of limestones are carbonate mud (micrite). The skeletal grains consist principally of planktonic foraminifera, oligostegina, calcisphers, ostracods, pelecypods, larvae ammonoids and echinoderms. Non-skeletal grains include rare peloids only. The Kometan Formation has been subjected to different diagenetic processes such as: micritization, dolomitization, cementation, neomorphism, compaction, silicification, solution, phosphatization, glauconitization and fracturing. All these occurred during marine phreatic shallow burial stage and activated during intermediate to deep burial and uplifting in the late stages. The paragenetic history of the Kometan Formation was passed through four diagenetic environments which are: marine, meteoric, burial and uplifting.

Keywords: Petrography, diagenetic stages, Kometan Formation, Northern Iraq

GK4-47

WATER AND SEDIMENTS YIELDS ESTIMATION: A CASE STDUY IN BAWASHASWAR WATERSHED\ IRAQI KURDISTAN REGION

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Abstract

Water flow in the seasonal streams, forms a vital source of water resources, particularly in arid andsemi-arid areas due to its high-water supply from the precipitation during the wet season.This research aims to estimate the quantities of water yield, surface runoff, and sediment yield in Bawashaswar watershed.The studied area is located about 101 km east of Kirkuk citywithin a semiarid region. It covers an area ~277 km2.The outlet of the watershed north of Kifri town was selected to construct Bawashaswar Dam for drinking, irrigation, livestock, and tourism purposes. Due to the risk of sediment accumulation and insufficient water within the reservoir to be invested for the mentioned purposes, this study comes to provide valuable information for the decision makers about water and sediments yields within the watershed and possibility of investment the water for the above purposes.We used the Soil Water Assessment Tool(SWAT)tools to achieve the aims of the study.Several datasuch as satellite images, DEM, land use/land cover, curve number (CN), daily climatic data of temperature, precipitation,and digital soil map have been used as inputs. We estimated the outputs include precipitation, evaporation - transpiration, percolation, surface runoff, water yield, loss of transport, sediments yield of the Bawashaswar watershed. The results will support the future development plans of the dam, through exploiting the permitted quantities of sustainable water and managing the sediment accumulation to mitigate its impact on the capability of the dam.

Keywords: SWAT, Percolation, Water yield, Sediments yield, GIS, Remote sensing

GK4-48

Sedimentology of the Oligocene and Miocene strata from selected outcrops in Sulaimani area, Kurdistan region, Iraq

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Abstract

The current study deal with the sedimentological study of the rock units belongs to the Oligocene – Miocene strata in Sulaimani area, Kurdistan region, Iraq. The detail survey; stratigraphic succession; petrographic investigations; have been integrated with the microfacies analysis.

This study reveals that the Bajwan, Anah and Jeribe formations are well exposed at the studied sections.

Almost, the Pila Spi Formation (Middle-Late Eocene) is unconformably underlain the Kirkuk Group .While the Fatha Formation (Middle Miocene) is unconformably overlain them. A general model is outlined for facies distribution and depositional environments during Late Oligocene- Early Miocene. Accordingly different carbonate system of marine environments are defined, which are represented by lagoon, shoal and reefal depositional environments.

Keywords: Health risk assessment, Heavy metals, Hydrogeochemistry, Arsenic

GK4-49

Health Risk Assessment of Heavy Metals in Ground and Tap Water of Chamchamal City -Sulaymaniyah Governorate / Kurdistan Region, Iraq

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Abstract

This study focused to determine the heavy metals (i.e. arsenic, copper, chromium, iron, manganese, molybdenum, nickel, lead and zinc) and other metals content in ground and tap water, and their health impacts in Chamchamal city, Sulaymaniyah Governorate, north-eastern Iraq. 25 samples were collected (i.e. thirteen groundwater deeply ranging (65-195m) and twelve tab water samples). IC-PMS from Acme Lab Canada, were used to measure the contents of those metals.

The spatial distribution of arsenic has been shown to be more concentrated in groundwater than in tap water (i.e. 1.33ppb and 1.17ppb respectively), possibly due to multiple sources including the residues of the industrial zone. While chromium content was reported higher within northern and southern parts of the city (i.e. 4.9ppb and 7.8ppb respectively), this could be related to the deteriorated well casing or due to the contamination with sewage and effluents.

This study concluded that the copper content in the studied groundwater samples is homogenous within all selected wells except in the southern part of the city which reaches 33.3ppb, this is possibly related to the waste and the products of fuel combustion of private electric generators within the study area. In contrast, iron content implies high concentration in comparison to the other studied heavy metals that reaches an average of 303.23ppb and 332.08ppb in ground and tap water respectively. This is higher than the recommended World Health Organisation (WHO) and Iraqi Standards (IQS) (e.g. 300ppb). This increase in the iron concentration might be related to anthropogenic, industrial and urban activities in the study area and /or to the corrosion of the wells casing material, and of the iron coated containers and pipes by time. Furthermore, the results show that there is an increase in heavy metals contents such as manganese, molybdenum and nickel (i.e. 323.23ppb, 8.9ppb and 4.8ppb respectively) in the northern parts of the city, possibly related to the industrial activities. Adding on, the spatial distribution of zinc in the groundwater increases in the southern and central parts of the city in comparison to the other areas especially in W2 and

W9 (i.e. 45.5ppb and 48.1ppb respectively). This could be related to the corrosion of the wells casing in addition to the industrial activities.

The Heavy metal potential index (HPI) values of some ground and tap waters are moderately polluted (e.g. W4, W8, W9, W10) and (D1 and D12) respectively. Whereas, W11 in the northern part of the city registered (highly polluted) with heavy metals (i.e. 85.864) which could be related to the industrial activates and filtration of these heavy metals from soil to water. Moreover, this study shows that there is no carcinogenic health risk of heavy metals in the studied area. The hazard index (HI) values of the groundwater and tap water samples in Chamchamal city appears to be less than one for all heavy metals in adults and children. The carcinogenic risk for arsenic, chromium and lead within the ground and the tap water are within the acceptable range (i.e. 1*10-4 – 1*10-6) for both adults and children.

Keywords: Health risk assessment, Heavy metals, Hydrogeochemistry, Arsenic

GK4-50

Larger Foraminifera and Paleoenvironmental Significance of Part of the Middle to Late Eocene, Damlouk Member, Ratga Formation, Western Desert, Iraq.

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Abstract

In this study the age and paleoenvironment of part of the Damlouk Member, Ratga Formation from a surface section in the Iraqi western desert is investigated. Twenty-eight species of larger foraminifera from the eleven genera and two species of coral and algae with fragments of bryozoan, and Mollusca, are recognized from the studied section. The assemblage is dominated by, *Nummulites* spp., *Alveolina* spp., *Rotalia* spp., and *Lockharitia* spp. The present palaeontological analysis aids in recognition the age of part of the Damlouk Member which ranges from Middle-Late Lutetian to Early Bartonian . Based on the distribution of the identified benthic forams, three basic environmentally significant assemblages were recognized. The back-shoal assemblage which is dominated by the occurrence of *Alveolina* and other imperforated forams, the shoal assemblages which is characterized by lensoidal and robust *Nummulites* of different species, and the fore-shoal assemblage which show higher diversity including: flat LBF such as lensoidal *Nummulite*, *Assilina*, *Lockharitia*, *Heterostigina* and *Operculina*. The three assemblages represent the transition from inner to middle ramp facies, with a water depth do not exceeds 50m, in a fairly low energy conditions.

Keywords: Larger Foraminifera, Eocene, Palaeoenvironment, Ratga Formation, Damlouk Member, Western Desert, Iraq.

GK4-51

Evaluating the relationship between the water table fluctuation and volumetric change of the groundwater in the Ibrahim-Awa aquifer/Penjwen

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Abstract

Palynofacies analysis was carried out on 28 outcrop samples from the Upper Triassic Baluti Formation from Zewa and Sararu sections, in south and northwestern of Amediya respectively, Kurdistan region- Iraq. Based on the studied palynofacies, both sections are quite different in terms of depositional environment. Using palynofacies analysis and amount of the organic matter category of Tyson (1995), four types of palynofacies were recognized as following; The palynofacies 1 (Pl.1) is observed in the lower, middle and upper part of Zewa section in which, is characterized by high amount of phytoclasts, medium percentage of Amorphous Organic Matter (AOM) and palynomorphs. This facies is referred to a depositional area that is located relatively nearshore with an arid hinterland. Pl.2 was observed in lower and middle part of Zewa section, which is characterized by high domination of palynomorphs (mainly bisaccates and monosaccate pollen grains) and a less amount of phytoclasts and AOM. This facies indicates the domination of shallow marine to continent environment. Pl.3 was observed in middle and upper part of the Zewa section and lower and upper part of the Sararu section. This facies showed less amount or absence of palynomorphs, and relatively high amount of AOM and phytoclasts. In addition to this, remarkable percentage of dinoflagellate cysts in Sararu section and foraminiferal test lining in Zewa section have been found in this facies. This facies indicates proximal suboxic-anoxic shelf. Pl.4 was observed in middle to upper part of Sararu section and characterized by less amount or absence of palynomorphs with high amounts of AOM and phytoclasts, which represent a deep environment of deposition.

Keywords: Baluti Formation, Kurdistan Region, Palynofacies, Depositional Environment, Sedimentary Organic Matter.

GK-52

Preliminary interpreting stable isotopes excursions in the Jurassic carbonate System, Imbricated Zone, Northern Iraq

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Abstract

The isotopic evolution of $\delta^{13}C$ and $\delta^{18}O$ was reported on bulk carbonate samples from the Jurassic succession in Imbricated Zone, North Iraq; to correlate them with the coeval sections in the adjacent basins. The $\delta^{13}C$ curves display similar patterns, especially through the Middle and Late Jurassic. The more negative $\delta^{13}C$ values are from Middle Oxfordian to Middle Tithonian and high $\delta^{18}O$ values are within the Kimmeridgian. This trend in the Kimmeridgian is due to the local environment conditions, may be attributed to upwelling of cold bottom water enriched in ^{12}C and ^{18}O. Consequently, the isotopic signals can be used for stratigraphic correlation. From the comparison with the global curves (Tethyan regions), we can differentiate between global and local events. The $\delta^{13}C$ records allow the detection of the global Early Bajocian and Middle Oxfordian transgressions, and the peak of Early Tithonian that represent the boundary between AP7 and AP8 Megasequences; the Early Berriasian excursion can be used for stratigraphic correlation. These records could be related to the increasing of the burial organic carbon. The $\delta^{18}O$ values revealed the Jurassic climate was regarded as a greenhouse climate with warm temperature and staid global conditions and warm temperature, with cool episode started from Callovian-Oxfordian transition and reach maximum Kimmeridgian followed by warming trend from Kimmeridgian- Tithonian. There are local variations, especially during the Early Jurassic, this could be related to the cementation and burial diagenesis.

Keywords: Carbon isotope, Excursion, Imbricated Zone, Jurassic System, Iraq

GK4-53

Late Cretaceous Ostracoda from The Shiranish Foramtion Dokan area, Kuristan Region-NE Iraq

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Abstract

Ostracods are described for the first time from Late Cretaceous (Late Campanian - Maastrichtian) deep marine sediments of the Shiranish Formation of Dokan area. They were collected using a new technique for releasing ostracod shells from a bluish white marl and marly limeston (hemipelagite). Twenty- two ostracod species are identified, belonging to the genera Bythocypris, Cytherella, Cypridopsis, Eucypris, Krithe, Mongolianella, Paracypris, Paracypretta, Parakrithe and Xestoleberis. The ostracod fauna supports a Late Cretaceous (Late Campanian-Maastrichtia) age for the Shiranish Formation of Dokan area.

Key words: Ostracods, Late Cretaceous (Late Campanian-Maastrichian), Shiranish Formation, Dokan area, Kurdistan region, Northeastern Iraq.

GK4-54

Depositional environment of Naokelekan Formation: insights from palynological study in Binari Serwan-1 well, ne Iraq

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Abstract

The sediments from Jurassic Naokelekan Formation have been studied in the oil exploratory Binari-Serwan-1 Well in Dokan Town, Kurdistan Region, Iraq. Both microscopic study and infrared spectrometry techniques were used for determining hydrocarbon generation potentiality. The Noakelekan Formation has a high Total Organic Carbon wt % content, ranging from 4.20 to 5.88 wt %.

The prepared strewn slides have been studied under polarizing microscope. The palynomorphs as well as phytoclasts are totally absent and only the amorphous kerogen was identified. This organic matter has no fluorescence, which are mostly of gas-prone type with possibility for oil generating. The concentrated kerogens of selected samples were analyzed by the Infrared Spectrometer. The results of these samples show kerogen type II and 47, which coincides with the microscopic study. The sediments were deposited in a marine, suboxic to anoxic environment.

Keywords: Naokelekan, Palynology, Infrared spectrometry, kerogen, amorphous organic matter

GK4-55

Kinematic and Slope Mass Rating Analysis of Road Cut Rock Slopes along Sulaimani-Qaradagh Main Road, Near Dararash Village, Kurdistan Region, NE-Iraq

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Abstract

The road network in the Baranan mountain, near Dararash village, connecting Sulaimani city with Qaradagh town, plays a great role in socio- economic activities of Qaradagh town and its surrounding villages. Any type of slope failure in the area may cause breaking up in traffic, loss of lives and injuries.

For assessing the stability of rock slopes in the area, seven stations (rock-cut slopes) were selected along the road and they were evaluated by kinematic analysis, using DIPS v6.008 software and slope mass rating system (SMR), using SMRTool - v205 software.

The Kinematic analysis revealed that planar and wedge sliding may occur in stations no.2, 5, 6, and 7, flexural toppling may occur in station no.1, direct toppling may occur in station no.2, and oblique toppling may occur in station no.3.

SMR- Tool software for discrete-SMR and continuous-SMR (CSMR), revealed that, stations no.2, 5, 6 and 7 are unstable slopes (class IV of a bad slope) with failure probability of 0.6 and with an exception for station no.7, which is partially stable slope (class III of a normal slope) by CSMR assessment with failure probability of 0.4. Station no.1 is partially stable (class III of a normal slope) with failure probability of 0.4 and station no.3 is stable slope (class II of a good slope) with failure probability of 0.2.

Due to the lack of structural and failure surface data (attitude of discontinuities and slumping surface) in station no.4, stability analysis was interpreted by general conventional method, depending on the field criterion and vision, it can be interpreted as rotational failure that its upper part consists of slump motion and the lower part of flow motion.

Keywords: Slope Stability, Kinematic Analysis, SMR, CSMR, Dararash

GK4-57

Slope Assessment and Suggested Slope Design of the Bekhme Residential Complex in North Iraq

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Abstract

Bekhme Residential Complex has been built on a natural slope. The naturally stable slope had been cut to eight steps. These steps are about thirty to forty meters in runs, with rise of about five to seven meters. The residential complex was built on these steps that supported by masonry retaining walls. Building operations were started in summer season and then, in next winter many failures take place. Three reasons of failures were pointed, weakness of slope materials, the effects of groundwater and unconsidered present design of slope pruning. The slope materials are representative by clastic rocks i.e. shale, mudstone, rock debris and soil. The groundwater incises the retaining walls at the two to three meters high from the base. Easy slope pruning style was used that made wide steps upraise five to seven meters. The field work includes photo documentations of failures in successive times, assess of prime design and slope materials investigation, monitoring the slope failures and demonstrate of tension cracks and groundwater level. Physical characteristics include grain size distribution and index properties were done in the laboratory to classify the slope materials. The peak and residual shear strength for four types of remolded slope materials were effectuates. The greater plasticity index of the lowest shear strength material shows the ability to compaction and demonstrates extra shear strength. Merely, five sites are presenting good factor of safety greater than 1.4 among 17 sites. The study concludes to repose suggested design; according to the whole information, which dealing to keep the original slope and prune the cuts in a stable mode. The study tries to maintenance and repairs the awful situation of the residential complex to save the souls and buildings.

KEYWORDS: Bekhme, Residential Complex, slope instability, slope materials, groundwater, slope design.

GK4-59

Petrography and Geochemistry of Gimo metacarbonates (Gole area Penjween District): constraints on the origin of protolith and its depositional environment.

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Abstract

Marble, represent a part of the global metamorphic succession, susceptible to post-depositional metamorphism and metasomatism. Studies of marble geochemistry are essential in the discrimination of tectonic settings of basins in which the limestones pre metamorphism were deposited.

Petrogenesis of Gole marbles in Penjween area, Kurdistan Region, NE Iraq has been studied through field occurrence, petrography and chemical composition. The marbles of Gole area are massive and slightly metamorphosed. Petrography of these marbles shows quite similar mineral composition with different textures such as homeoblastic to mosaic textures. The opaque grains identified in some samples which are a good indicator to mineralization in the studied samples. The major element composition of eight representative samples of the marble deposit was determined using X-ray fluorescence. The CaO content in samples range between 54.6 to 51.1% while the range of MgO depleted between 0.46 wt. % to 0.74 wt. %. The average of calcium carbonate ($CaCO_3$) content of the marble is 94.96% thus provide that the marble deposit is a pure calcite marble. The silica content is slightly various and range between 0.67 to 1.68% except two samples (G4 and G7) that showed higher silica content 3.18 and 4.61% respectively. The higher silica content generally indicates that the basin of deposition of the pre-metamorphic limestone protolith is near to the shore. The very low alkali content of Na_2O and K_2O in the studied marble deposits also revealed a shallow, saline environment of deposition of the limestone protolith. The concentration of Sr and Zn are slightly low by compare to the deep sea carbonates and more tolerate with shallow carbonates. The ternary diagram of Ba-Rb-Sr and Sr/Ba vs. Sr/Rb diagram revels that the marble originally deposited in continental margin environment. The average LREE/HREE= 6.6, this enrichment sings to some degree of fractionation, also ΣREE indicates to typical of Paleozoic and Proterozoic of the parent limestone. The low Er/Nd ratio (0.14) signs to the metacarbonate slightly influence by detrital materials.

Keywords: Gimo, Gole marble, Metacarbonate, Homeoblastic , Mosaic textures

GK4-60

Sterane biomarker analysis of Sargelu Formation, Miran West Field, MW-2 well, Kurdistan Region, NE Iraq: Implications for origin of organic matter, palaeoenvironment and maturity

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Abstract

Sargelu Formation (Middle Jurassic) is well known to be one of the most important and wide distributed source rocks in Middle East. In this study, nineteen cuttings samples from Sargelu Formation were studied from one subsurface section within Miran West Field (well MW-2) in Sulaimani Governorate, Kurdistan, Iraq. The well penetrated the Formation in the interval 2375m to 2475m, which is mainly composed of argillaceous limestone and shale. The Total Organic Carbon (TOC wt.%) for all samples calculated from the sonic and resistivity logs using Passey et al. method for TOC estimation from wireline logs. All samples have been analyzed by Gas Chromatography/ Mass Spectrometry (GC/MS) in order to identify and study the biomarkers distribution in the selected rocks. The range content of TOC% in the selected intervals is between 0.654 and 6.53%. Reflects well preservation and high productivity of organic matter in reducing/anoxic depositional environment. All study samples show the dominant of short chain n-alkanes between C_{15}-C_{18}, with isoprenoids pristane (Pr) and phytane (Ph). The average of Pr/Ph ratio in the samples was 0.95, indicating to anoxic, and commonly marine carbonate environments. Most of the studied samples show unimodal envelope chromatograms, maximum peak carbon n-C_{15}- n-C_{20}, and low CPI values (0.89-1.17) indicated a predominance of marine input, and the organisms derived from phytoplankton, zooplankton and benthic bacteria with minor photosynthetic and terrestrial plants. The calculated odd over even predominance (OEP) for the studied samples show near value 1.0 (av. 0.94). In most studied samples, the C_{27} and C_{29} steranes predominate over the C_{28} steranes, reflecting a high contribution of aquatic planktonic-bacterial organic matter with a minor terrigenous organic matter input. The studied samples have C_{29} 20S/(20S+20R) and ββ/ (ββ+αα) isomerization values ranging from 0.39 - 0.58 and 0.48 - 0.65 respectively, indicating high mature source rocks of Sargelu Formation in this well.

Key words: Sargelu Formation, Jurassic, Kurdistan, Hydrocarbons, Biomarkers

GK4-62

Origin of the Phacoid Zone within the Chia Gara Formation, Kurdistan Region, Iraq

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Abstract

Special structural bodies exhibit randomly occur in the sequence of Chia Gara Formation in the northwestern part of Zagros thrust and belt zone-Kurdistan region-Iraq. These structural features are spherical to semi spherical shape construct a zone in the carbonate sequence of Chia Gara Formation. We describe and designation this zone as Phacoid Zone. This zone is characterized by the presence of number of ball-like structures within the host rocks. The diameter of these balls ranged from 20cm to about 1.2m. They are harder than the host rock (mostly calcareous shale) and forming ridges at the outcrop. The lower part from eight outcrop sections of Chia Gara Formation have been reviewed and one of them studied in detail for determining the origin and method of their formation. This zone is characteristic for the lower part of Chia Gara Formation and presence where the Chia Gara Formation observed. Petrographically, the balls are mostly organic matter –rich bioclastic lime wackestones. The bitumen are present in sub-parallel lines in a calcareous groundmass. However, the host rock is generally composed of calcareous shale rich in organic matter but without any fossils. The carbonate phacoids form in competent/incompetent sequence. The mechanism of forming these carbonate phacoids are related to the compression stress and digenesis affected on the carbonate/shale strata. The block of limestone rolling due to continue compression shear stress that in the final stage form the carbonate phacoid.

Key words: Chia Gara, Phacoid, Kurdistan

GK4-65

Hydrocarbon Movaebility Detection in the Carbonate Jeribe Reservoir from Selected Wells in Hamrin Oilfield/Northern Iraq

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Abstract

The Middle Miocene Jeribe Formation has been studied from three selected wells in Hamrin Oil Field, Northern Iraq.

The formation appeared to contain different ratios of shale being highest in the middle part of the formation and exceeding 50% in some depth intervals.

The existence of the gas in the two wells of Hr-49 and Hr-51 detected from the relationship of the neutron and density logs. Secondary porosities contributed in the total porosity of the formation by different percentages reached in some intervals to about 7%.

Water saturations in Jeribe Formation are relatively higher in the well Hr-51 than the other two studied wells (especially the lower part of the formation). Most of the reservoired hydrocarbons in the well Hr-51 was movable and that in contrast to the hydrocarbons in the Jeribe Formation in the well Hr-50 which appeared to be containing the highest ratios of residual hydrocarbons.

Jeribe Formation characterizes by four Flow Zone Indicators (FZI) representing four unique hydraulic flow units. The calculated values of Movaeble Hydrocarbon Index (MHI) and Production Ratio Index (PRI) showed that Jeribe Formation in the studied wells can produce hydrocarbons associated with different volumes of water with being the upper part of the formation the best for production.

The less produced water is in the reservoir unit RU-4 and the highest water production is in the reservoir RU-1 (gradual increase of associated water production from top of the formation towards the bottom of the formation).

Key words: Jeribe, Hydrocarbon movaebility, Flow zones, Production Ratio Index

GK4-67

Assessment of Groundwater Quality of up Al-Khassa Dam Sub-Basin Kirkuk/NE Iraq

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Abstract

This paper aims to assess the pollution levels, and quality of groundwater in up Al-Khassa sub-basin area, as well as identify its suitability for drinking, livestock, and irrigation purposes. The eleven groundwater samples were collected from the study area, hydrochemical analyses of major ions, heavy metals and some other physico-chemical parameters. In order to assess the groundwater quality, the concentration of mentioned variables compared with standards of World Health Organization (WHO), as well as the WQI was determined. The results showed that all groundwater in the study area in the two seasons are unsuitable for drinking purpose, except in W7 which is accepted, and it is suitable for livestock and irrigation purposes.

Keywords: Groundwater quality**,** Al-Khassa sub-basin, Water quality index, Heavy metal, Pollution index.

GK4-68

Evaluation of groundwater quality of the area between Al-Khassa dam and Kirkuk structure / NE Iraq

(Poster)

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Abstract

This paper aims to evaluate Water Quality Index (WQI) of groundwater in the study area. The samples were collected from (8) wells located in different areas during three different times in (10, 1, 4 months) of 2017. The groundwater samples were analyzed for pH, Turbidity, total dissolved solids and total hardness and the other major ions (Ca^{2+}, $Mg2^{+}$, Na^{+}, K^{+}, So_4^{2-}, Cl^{-}, HCo_3^{-}) and Heavy metals (Fe, Pb, Ni, Zn, Cd, Cu, As, Cr). In order to evaluate the groundwater quality, the concentrations of variables compared with standards of World Health Organization (WHO), as well as the WQI and HPI were evaluated. The suitability of groundwater in the study area are unsuitable for drinking purpose except in W5, and it's all suitable for irrigation and industrial and livestock purposes.

Keywords: Groundwater quality, Water quality index, Heavy metal pollution index, Kirkuk, Al-Khassa dam, Iraq.

GK4-72

Reservoir Characterization for the Aptian Lower Qamchuqa (Shua'iba) Formation from the well BH-86 of Bai- Hassan Oilfield/Northern Iraq

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Abstract

The petrographic and reservoir characterization study of the Aptian Lower Qamchuqa (Shu'iba) Formation has been done from the well BH-86 of Bai- Hassan Oilfield in Kirkuk area which is located in the Low Folded Zone within the Unstable Shelf of Northern Iraq.

The study of 89 thin sections revealed that the formation in the studied well lithologically consists of shaly limestone, thin bed of marl within limestone, and dolomitic limestone.

The formation subdivided into four main microfacies represented by Lime mudstone microfacies, Dolomudstone microfacies, Lime wackestone microfacies (additionally subdivided into benthonic foraminifera lime wackestone submicrofacies and bioclasts lime wackestone submicrofacies), and Lime packstone microfacies (additionally subdivided into pelloidal lime packstone submicrofacies and Orbitolina lime packstone microfacies).

Shale content calculated from the gamma ray log showed that the formation is mainly of low shale content (less than 35%).

The porosity determined from sonic, density, and neutron logs showed that the formation is generally owns between <1 and 15% porosity being in some intervals about 6% of them secondary type porosity. The estimated permeability from core test data and logs using Multi Regression Method analysis for the formation appeared to be generally low permeability (between <0.01 and 2.0mD).

The formation subdivided to six reservoir units depending on variations in shale content, porosity, and permeability.

The unit RU-5 is of the best reservoir properties among the identified units with average shale content about 3.15%, porosity about 6.2%, and about 1.75mD average permeability. On the other hand, the least reservoir property exist in the unit RU-1 with average 9.48% shale content, 3.64% porosity, and 0.5mD average permeability.

The study also revealed that the fractures contribute in the flow within the Lower Qamchuqa Formation which looks that fluids are flowing through the formation in four unique Hydraulic Flow Units (HFU).

Only about 8% of the gross 146m of the formation is expected to be of the required reservoir properties for oil production and about 68% of the required reservoir properties for gas production. The actual productive thickness for oil is only about 2.8% from the gross studied section, whereas more than 50% of the gross can considerer as productive thickness for gas.

Key Words: Lower Qamchuqa, Bai-Hassan, Microfacies, Reservoir characterization, Net to Gross

GK4-75

Evaluation of the Bekhme Dam site by the proposed rock mass strength reduction system

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Abstract

The proposed Rock Mass Strength Reduction System RMSRS depends on the effects of discontinuities to reduce the strength of rocks. The reduction of rock mass strength happened when the properties of discontinuities is inferior. Most classification systems in worldwide used are employ the engineering parameters separately. The association of the related parameters and subsequent correlations are the base of the RMSRS. The RMSRS would be applying systematically in multiple stages to arrive the final view of the site. The system can be applied at any engineering site has rock mass varied between soil properties to intact mass. The application of RMSRS at the Bekhme Dam Site – NE Iraq has clarified the separation between the zones of different rock mass quality along the Bekhme Gorge, Spillway, and Access tunnels. The proposed dam site is classify as high quality by RMSRS, which is classified between 4-10 according to Q-System, high according to RMR and 10-1 according to RMi. At the Spillway Tunnel there are three small zones having very low grade at the distance from the SW entrance, two zones having low grade and two zones having medium grade. The best qualities extend at the eight long zones and there are five zones having very good quality. At the Access Tunnel, there are two very low-grade zones near the SW entrance, six low-grade zones and eight medium grade zones. Approximately half the length of the tunnel has good and very good quality for five zones and four zones very good.

GK4-76

Organic matter characterization of selected samples from well-1 in Chaq Chaq area, Sulaimani Governorate, Kurdistan, NE Iraq

(POSTER)

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Abstract

The studied well is located in Sarchinar Resort, near the abandoned cement factory, Sulaimani City, Kurdistan, northern Iraq. The ChaqChaq-1 well drilled as a part of hydrogeologic study for groundwater exploitation in Sulaimani, Iraq. According to tectonic subdivision of Iraq, the well is located in the High Folded Zone. Sarchinar Resort located at southern plunge of Piramagroon anticline. Likewise within Sulaimani city, exposed rock units of the Upper Cretaceous observed, which are related to extensive orogenic and intensive erosion common in the area. Herein, the lithologic description and terminology of geological formations provided by the drilling company fall short to be correct! They recognized the unit beneath Kometan Formation as Qamchuqa Formation (Final Report-2011). In this study we re-checked the microfacies and with evaluation of foraminifera genera, to determine that the underlain formation of Kometan is Balambo or Qamchuqa Formation.

Four core samples from Chaq Chaq well-1 (depth interval 57-400m) were studied petrographically and palynologically, as well as were analyzed by Infra-Red (IR) spectroscopy. Two samples from Balambo (Qamchuqa!) Formation and the other two from Kometan Formation. Samples are carbonates; rich with planktonic fossils and organic matter. Three types of microfacies have been recognized, which are; 1- Planktic foraminiferal wackstone-packstone, 2- Planktonic foraminiferal packstone, and 3- Mudstone. The selected borehole lithostratigraphic succession is comprising Kometan and Balambo formations, based on microfacies study. Palynological strewn slides are rich with amorphous organic matter (AOM) (>90%) with few percentages of palynomorphs and phytoclasts (less than 10%).Three types of AOM identified (i.e. A, C, and D) based on Thompson and Dembicki (1986). The palynofacies type identified to be; deposited in deep basin or stratified shelf sea under anoxic environment. The Infrared spectra of the samples indicate the presence of kerogen type II within mature stage correspond to 0.5-0.6 % Vitrinite Reflection. Thermal Alteration Index (TAI) indicate onset of main phase of liquid petroleum generation, a range from 2- to 2+.

Key words: Organic Matter, Kurdistan, Kometan Formation, Balambo Formation, Kerogen, Palynofacies, Infrared spectroscopy

GK4-77

Calcareous nannofossil study of the Fatha Formation at Miryas section, Qaradagh Mountain Series, Sulaimaniyah, Kurdistan Region/Iraq

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Abstract

The Fatha Formation is widely distributed in the Low Folded Zone and it is less-distributed in the High Folded Zone of Iraq. A nannostratigraphic study is conducted at Miryas locality. Hence, the lithology of the Fatha Formation is consisted mainly of claystone, siltstone, marlstone and gypsum, with minor distribution of limestones. Ten samples logged a marl-dominant unit of the lower part of the formation. This unit is located between the red claystones of the Miryas section that is located within the High Folded Zone at the Qaradagh Mountain Series, Southwest of Sulaimaniyah-Kurdistan Region/Iraq. On the basis of the fifteen identified calcareous nannofossils, two biozones are recorded from the upper part of the Fatha Formation; they are NN1 and NN2 Zones. The combined stratigraphic ranges of the calcareous nannofossils identified from the study section of the upper part of the Fatha Formation support the Lower Miocene-Aquitanian; *Sphenolithus belemnos*, *Sphenolithus cometa*, *Sphenolithus procerus*, *Sphenolithus tintinnabulum*, *Sphenolithus delphix* and *Sphenolithus capricornutus* are marker species of that age. These species are also accompanied by the occurrence of *Sphenolithus moriformis*, *Cyclicargolithus floridanus*, *Reticulofenestra minuta*, *Reticulofenestra bisecta*, *Reticulofenestra minuta*, *Reticulofenestra dictyoda*, *Coccolithus pelagicus*, HELICOSPHAERA CARTERI and *Coronocyclus nitescens*.

Keywords: Fatha Fn., Lower Fars Fn., Sphenolithus belemnos, High Folded Zone, Qaradagh Mountain Series, Sulaimani, Kurdistan, Iraq.

GK4-78

Ridge-axis and Off-axis volcanic massive sulfides, Cyprus-type, in the Mawat ophiolites, Kurdistan-Iraq

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Abstract

The Zagros orogenic belt is a part of the Alpine-Himalayan orogenic system which streatches in continuity between the Turkish Taurus and the Iranian Zagros ophiolites, complementary with those in Balkans in Europe and to Pakistan and Tibet in Asia. Tectonic analysis of the **Mawat ophiolit complex** registered system of rupture elements of variable intensity and strike directions, marking the thrust-fault boundaries of the Mawat ophiolite complex. The first order E-W elements delineate the boundaries among three major tectono-stratigraphic units: i) **Nothern Mawat Group (NMG)**, (ii) **Median Intrusive complex (MIC),** (iii) **Southern Waraz Group** (**SWG)**. SWG has fully developed sheeted dyke complex, while its existance in the NMG and MIC is ambiguous. In addition, NMG and MIC have significantly different mélange units.

Sulphide mineralisation in the Mawat ophiolites is a part of the sub-sea floor alteration process. The mineralisation events in the Waraz meta-basalts are diachronous and not formed from the single fluid and under the same P/T conditions. Its polyphase character could be constrained, at least, into two major episods: 1) The low temperature hydrothermal (LTH) and 2) The high temperature hydrothermal episode (HTH). They differ by contrasting alteration assemblages. The HTH is related to intrusion of plagiogranites which play active role in the ore forming process. It implies a new regional magmatic impulse as a source of heat and energy for hydrothermal circulation. **While the low temperature episode (LTH) is related to magmatism along the ridge-axis, HTH is an off-axis event.**

The major VMS deposit prospects and Cu-ore showings are situated within the „Shear Zone“, gently arcuated tecto-magmatic belt trending NW-SE, along the western side of the Median Intrusive complex from Mawat village toward the Waraz area. It encountered basic and acidic intrusions, diorites, quartz dolerites and plagiogranites, with pervasive epidotisation, as a dominant alteration process. The Shear Zone ore occurences are parallel with the possible palaeo-spreading ridge-axis, but coincide with a newly established off-axis ridge, displaced temporally and spatially during supra-subduction initiation.

Keywords: VMS, Cyprus-type, supra-subduction ophiolites, plagiogranites, mélanges, Mawat ophiolites

GK4-79

Suitability evaluation of claystone of Gercus Formation in some selected areas of North Iraq for Dam Filling materials

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Abstract

In this study, a geotechnical and Engineering assessment was conducted for clays of the Gercus formation in selected areas of northern Iraq to determine its suitability for Embankment Dams, (6) samples were collected from two sites: the first location (Dokan) (3) samples and the second location (Haibat Sultan mountain) by (3) samples also for the purpose of conducting various geotechnical tests on them (physical, mechanical, chemical, mineral).

The results of the geotechnical assessment of physical tests through Grain Size Test showed their conformity with (Zone C) curves and their suitability for embankment dams, according to SORP/ R5 **[1]**.

The results of the plasticity limits tests for the clays of the study area showed that the soil is of fine type, some it (silt) low plasticity (ML) and others (clay) low plasticity (CL) according to the standard soil classification **[2]**, and the water content of plasticity limits (liquidity limit, plastic limit, plasticity Index) of these clays conformity within the limits of (SORP/R5) **[1]**.

The results of modified compaction test (maximum dry density, optimum moisture content) were found to have a density of not less than (1.962) g/cm^3 with a moisture content (11.5%) and thus comply with the limits of the general specification (SORP/ R5) **[1].**

The results of the of permeability Index (K) for clay of the study area that it's have low permeability according to the classification (Das, 2008) **[3]**, and therefore showed their suitability as raw materials in the construction of embankment dams.

Chemical tests (sulfate content, organic materials content, total dissolved salts , gypsum content, and pH value) were found to fit the requirements for use for the purposes of dams in accordance with the Iraqi standard (SORP/R5) **[1]**, mentioned above.

GK4-80

Palynofacies and Palaeoenvironmental interpretation of the Upper Triassic Baluti Formation, Kurdistan Region- Iraq

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Abstract

Palynofacies analysis was carried out on 28 outcrop samples from the Upper Triassic Baluti Formation from Zewa and Sararu sections, in south and northwestern of Amediya respectively, Kurdistan region- Iraq. Based on the studied palynofacies, both sections are quite different in terms of depositional environment. Using palynofacies analysis and amount of the organic matter category of Tyson (1995), four types of palynofacies were recognized as following; The palynofacies 1 (Pl.1) is observed in the lower, middle and upper part of Zewa section in which, is characterized by high amount of phytoclasts, medium percentage of Amorphous Organic Matter (AOM) and palynomorphs. This facies is referred to a depositional area that is located relatively nearshore with an arid hinterland. Pl.2 was observed in lower and middle part of Zewa section, which is characterized by high domination of palynomorphs (mainly bisaccates and monosaccate pollen grains) and a less amount of phytoclasts and AOM. This facies indicates the domination of shallow marine to continent environment. Pl.3 was observed in middle and upper part of the Zewa section and lower and upper part of the Sararu section. This facies showed less amount or absence of palynomorphs, and relatively high amount of AOM and phytoclasts. In addition to this, remarkable percentage of dinoflagellate cysts in Sararu section and foraminiferal test lining in Zewa section have been found in this facies. This facies indicates proximal suboxic-anoxic shelf. Pl.4 was observed in middle to upper part of Sararu section and characterized by less amount or absence of palynomorphs with high amounts of AOM and phytoclasts, which represent a deep environment of deposition.

Keywords: Baluti Formation, Kurdistan Region, Palynofacies, Depositional Environment, Sedimentary Organic Matter.

GK4-81

Attenuation and Excitation of High-Frequency Ground Motion in Kurdistan Region, Iraq

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Abstract

To provide useful seismic information to earthquake engineers about areas where there is limited exposure to large earthquakes but large numbers of small local earthquakes (in this case, from Kurdistan Region, Iraq), it is possible to generate ground motion prediction models by analyzing high-frequency ground motions. Rates of ground motion attenuation during propagation and variations in the source excitation as functions of magnitude are parameterized in the 1-12 Hz frequency range for earthquake ground motions recorded in the 5-500 km distance range at 10 seismic stations within Kurdistan Region, Iraq. Regression results for the Fourier velocity spectra and peak velocities at selected narrow bandpass-filtered frequencies are used to define a piecewise-continuous geometrical spreading function, frequency-dependent Q(f), and distance-dependent duration that can be used with random vibrations to predict ground motions as a function of magnitude and epicentral distance. The site terms agree well for all components of motion for mountainous sites and high values of site terms observed at sites where thick alluvial deposits are present and high anthropogenic noise is anticipated. Modeling indicates that the average regional attenuation of the peak ground motion is best fit by a geometrical spreading function of r^{-1} for r $\geq$ 1 km, $r^{-0.95}$ for r $>$ 40 km, r^{0} for r $>$ 120 km, and $r^{-1.25}$ for r $>$ 195 km. The frequency-dependent quality factor is Q(f) = 320 $f^{0.25}$.

KeyWords: Attenuation, Shear wave, Excitation, Ground motion, Geometrical spreading

GK4-82

Dam sites selection using remote sensing and GIS: Case study of Al-Khabur River Basin, Kurdistan Region, Iraq

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Abstract

This work aims to estimate the suitable places to build new dams upstream of Mosul Dam (MD), which is suffered from subsidence in its body. For this purpose, we used Landsat OLI to classify the land cover, and Digital Elevation Model (DEM) of Shuttle Radar Topography Mission (SRTM) to determine the stream order for each valley of the Mosul Dam Basin and its watershed.

The watershed covers about 2599 km² and encompasses the parts of Mosul and Dohuk Governorates in the north-north west of Iraq. The stream order reached to order-eight depends on Strahler stream order classification. The Mosul Dam Reservoir Basin (MDRB) is part of Tigris River Basin. It is estimated area upstream of MD. Its catchment area extends partly into Syria (826 km^2, i.e., 1.617 % of the total area) and Iraq (5,438.5 km^2, i.e., 10.645 % of the total area), while the major portion (44,826.5 km^2, i.e., 87.738 % of the total area) is in Turkey. The total length of 154.518 km extending from the joining of the Tigris and Botan branches at the Ilsui Dam near Koctepe village to its confluence with the Mosul Lake. The longest part of TRUMD is 607.03 km

For the period between 1931 and 2013, the average monthly discharge for the Tigris River was 631 m3.sec-1. The maximum discharge was 3,514 m3.sec-1 in April 1954, whilst the minimum was 81 m3.sec-1 in October 2013.

We tested the valleys have stream order more and equal four in order to find the location of suitable dams' locations within Iraqi part. We used high resolution data represented by QuickBird with resolution 60cm. We successfully determined nine sites suitable to be dams.

Keywords: DInSAR; PSI; gypsum; Mosul Dam; Iraq

GK4-83

Mineralogy and petrography of Sulfide and oxide mineralization in Sirstan, Kurdistan region

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Abstract

The study region is located in the Sirstan village, 120 km NE of Sulaimani city, in the east of the Kurdistan Region. Metallized quartz veins in Sirstan hosted by granodiorite of the Shalair zone. Five zone recognized from the country rock to the center of the vein according to the mineral constitute which are granodiorite oxide mineralization with quartz, sulfide mineralization, the large grain of quartz, and the tourmaline. The mineral assemblage of granodiorite is representing by quartz, plagioclase, green amphibole, and chlorite. Magnetite and ilmenite are the primary mineral in the oxide zone. Pyrite is the main ore mineral in the sulfide zone. Hematite and goethite replace the primary ore mineral as vein and rim replacement texture due to supergene enrichment processes. Petrography of the silicate minerals show that the rock underwent different stage of metamorphism.

Keywords: Sulfide; Oxide; Shaliare valley; Quartz vein; Kurdistan Region; Iraq

Geological Field Trip

To Sharbazher area, in the Zagros High Folded-Thrust Belt Kurdistan Region, Iraq

Thursday 10 October 2019

Note:

- **The field trip will be on Thursday 10th Oct. 2019**
- **Registration for field trip will be open from Tuesday afternoon on 8th Oct. 2019**
- **Registration fee 10000 IQD (Bus, Lunch and Handout included)**
- **Hosts by Dr. Kamal H. Karim and Dr. Yousif O. Mohammed**

GEOKURDISTAN IV

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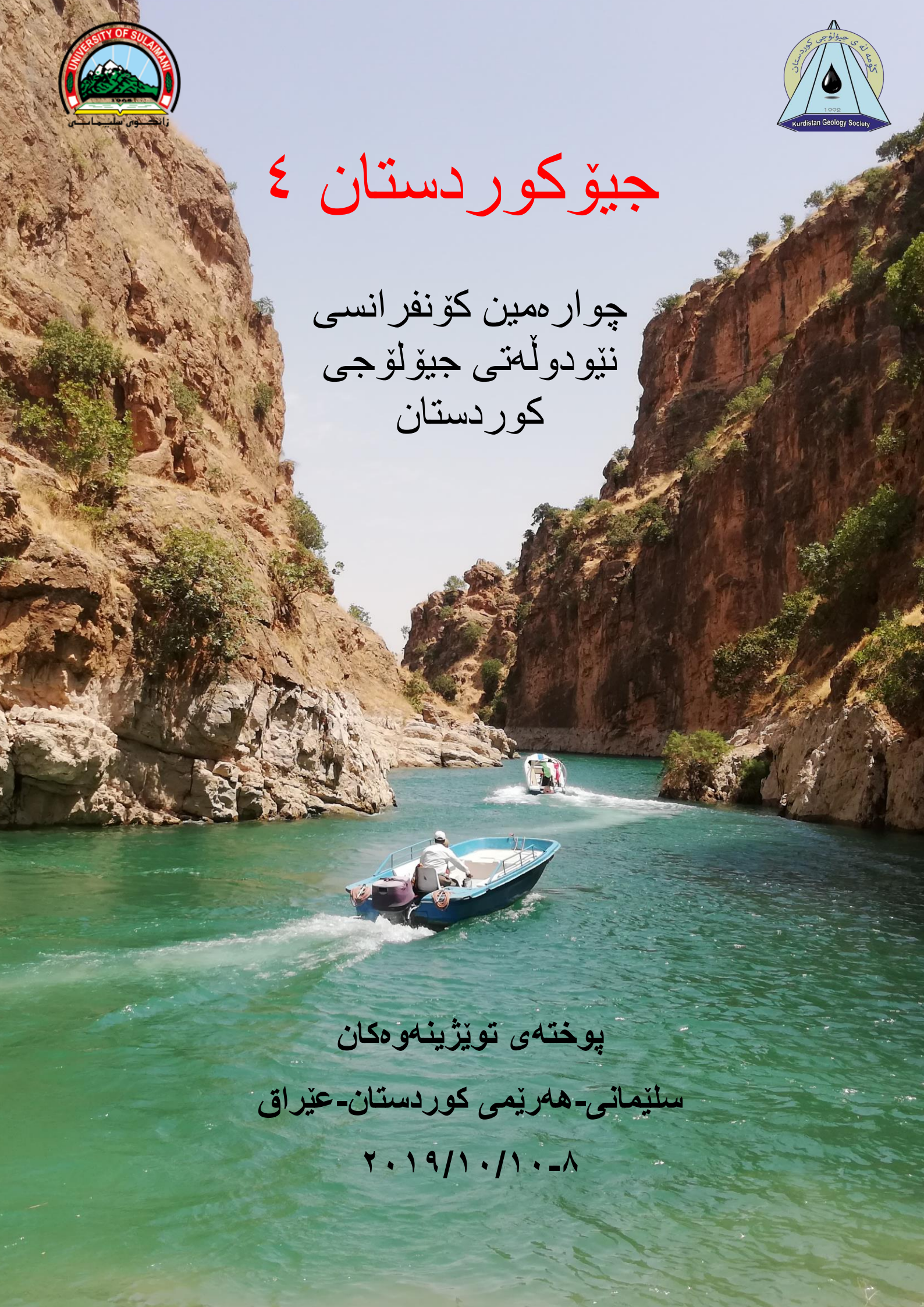

جیۆکوردستان ٤

چوارەمین کۆنفرانسی
نێودەوڵەتی جیۆلۆجی
کوردستان

پوختەی توێژینەوەکان

سلێمانی-هەرێمی کوردستان-عێراق

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