GEOKURDISTAN III-2017 The third international geological conference of Kurdistan

Abstracts Volume December 5-7, 2017 Sulaimani, Kurdistan Region, Iraq

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The third international geological conference of Kurdistan





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Program of GeoKurdistan III

Day 1 Tuesday	05 th Deceml	per 2017		
09:00-10:00	Registration	Registration		
10:00-10:15	Welcome ar	Welcome and opening of GeoKurdistan III		
10:15-11:00	Keynote spe	akers		
	-Hadi A. Rasuli, -Aram N. Taufe Sulaymaniyah o seismology.	Department of Geology, Kurdistan University, Sina-Iran. q, Omer Q. Ahmed, Department of geology, UOS, and Bakir M. Saied, lirectorate of meteorology and seismology/ data center of		
11:00-11:30	Coffee Brea	k		
11:30-12:30	Session 1			
12:30-14:00	Lunch (Univ	ersity Campus Restaurant)		
14:00-15:30	Session 2			
15:45	Departure to	o the Hotel by bus		
Day 2 Wedneso	lay 06 th Decem	per 2017		
09:00-11:00	Session 3			
11:00-11:30	Coffee Brea	k		
11:30-13:00	Session 4			
13:00-14:30	Lunch (Univ	ersity Campus Restaurant)		
14:30-16:00	Session 5			
16:00-17:00	Closing sess	on		
20:00-22:00	Dinner			
22:00	Departure to	o the Hotel by bus		
Day 3 Thursday	07 th Decemb	per 2017 (Field Trip)		
8:30	Departure from	the Hotel by bus		
09:30-10:30	Stop No.1.	Zewe gorge		
11:00-11:45	Stop No.2.	Jasana Cave		
12:15-13:30	Stop No.3.	Dukan dam		
13:30-15:30	Stop No.4.	Lunch time		
15:30	Departure to th	e Hotel by bus		





Preface

GeoKurdistan III conference is an international meeting that brings together geoscientists interested in the geological studies on Iraqi Kurdistan Region and surrounding countries. It was founded few years ago and has growing "slowly but steadily "as an important



platform for geological activity and researches in Kurdistan. This is due to the various conflicts and crises that have engulfed the region. The purpose was to expand geological activities and to exchange and update information regarding mineral resources and economic geology, water resources, oil and gas exploration, and environmental geological problems. The conference welcomes all varieties of studies over a wide scope of geological disciplines that expected to contribute to the geological development of the area.

The main goal of this conference is to evaluate the present-day geological knowledge and information regarding raw material, water, and hydrocarbon resources and to motivate geologists to encourage geological studies and activities in Kurdistan. We believe that it would build the basis for upgrading the academic and scientific levels at universities and research institutes, and enhance the performance of the Geological Directorates of Kurdistan Region.

From a scientific point of view, Kurdistan is interesting area not only for its richness in mineral resources and oil and gas and other natural resources but also it represents a key-area within the Zagros orogeny for the magnificently preserved Tethyan geotectonic belts and associated sedimentary basins. The latest unusual earthquakes that had hit Kurdistan provide a good opportunity for further scientific debate and mutual cooperation between specialized institute of the area. This requires more joint geological researches and cooperation focusing on topics such as stratigraphy, geophysics, structural geology, tectonics, hydrogeology, paleontology, etc.





The idea to organize this conference originated during the meeting between a staff member of the department of geology at University of Sulaimani and the Kurdistan Geologists Organization in 2010. I am delighted that many Kurdish geologists from Kurdistan are supporting this idea. The GeoKurdistan III will be held while our country is facing the challenge of defeating the extremist group known as the Islamic State, in addition to economic and political crisis. I also would like to use this opportunity to pay our respects to the Peshmerga and brave soldiers, 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. Many thanks go to international coalition for supporting the defeat of ISIS.

I am greatly indebted to all members of the organizing and advisory committees of this conference, and the geology department staff, whom without their help this conference could not have taken place. My appreciation extended to the Halabja Group Company, the authorities of the University of Sulaimani specially the president Dr. Ridha Hassan Hussein, and the Kurdistan Geology Society and Kurdistan institution for strategic studies and scientific research, Sulaimani for their sponsoring and supporting the conference activities,

Dr. Diary Ali Mohammed Amin Al-Manmi

Chair/ Department of Geology University of Sulaimani

Sulaimani, December, 2017









GEOKURDISTAN III

The Third International Geological Conference of Kurdistan

December 5-7, 2017

Sulaimani, Kurdistan Region, Iraq

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List of accepted papers for presentation at GeoKurdistan III

After reviewing the submitted full text of papers, the following papers have been accepted for presentation in the conference, GeoKurdistan III in 5-7 December, 2017.

The Organizing committee

GEOKURDISTAN III

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15/9/2017





List of Accepted papers:

GK	K Authors Affiliation		Title of paper	Correspondent author
3-				
1	Varoujan K. Sissakian ¹ ,	¹ Private Consultant	The lateral growth of Qaradagh	varoujan49@yahoo.com
	Rahim M. Amin ² and Geologist, Erbil, Ainkawa-		Anticline, A tectonic-	
	Jamal Gh. Mohammed ²	108. University of	geomorphological study, South of	rahim482003@vahoo.co
		Kurdistan, Hawler	Sulaimani city,	<u>m</u>
		² Retired Senior Chief	Kurdistan Region, Iraq	ismal105482@gmail.com
		Geologist, Erbil		Jamai 193463@gmail.com
2	Zivad Flias [*] and	*Geomorphic researcher	Indicating the Tectonic Activity of	zivadelias@vahoo.com
-	Verewier K. Geschier**	Hannover – Germany,	Kifri Chai Basin, Using	<u>ziyuuciusee yunoo.com</u>
	varoujan K. Sissakian	** Consultant Coologist	Geomorphological Indices, the	
		Liniversity of Kurdistan	Kurdistan Region, NE Iraq	f.kajeek@ukh.edu.krd
		Hewler,		varoujan49@yahoo.com
2	Full toxt not submitted			
5	Full text not submitted	1		
4	Varoujan K. Sissakian ¹ ,	¹ Private Consultant	Slope stability of Darbendikhan	varoujan49@yahoo.com
	Sakar A. Sdiq ² and	Geologist, Lecturer in	dam and near surroundings. A	sakarbakr91@gmail.com
	Govar K. Haris	Hawler	Kurdistan region NE Irag	govar@gmail.com
		Erbil, Ainkawa-108		
		² Mining Resource		
		Engineer		
		³ Mining Resource		
		Engineer,,		
5	Varoujan K.	¹ Private Consultant	Factors controlling the	varoujan49@yahoo.com,
	Sissakian ¹ , Arsalan A.	Geologist, Lecturer in	development of wine glass forms	f.khajeek@ukh.edu.krd
	T. Shihab ³	Hewler, Erbil	in the mountains of Kurdistan	ahadsat1975@gmail.com
			Region, Iraq	
		² Iraq Geological Survey,		
		Sulaymaniyah Unice,		
		2		
		^a Iraq Geological Survey,		
		Baghdad		
	X 7 • X 7		A	1
6	Varoujan K. Sissakian ¹ , Divar S	Geologist. Lecturer in	Assessment of Dukan landslides, a case study. Dukan dam reservoir	varoujan49@yahoo.com
	Mohamed ² and	University of Kurdistan,	west of Sulaimani city, Kurdistan	d.saleh@ukh.edu.krd
	Sarhang Ahmed ²	Hawler	region, Iraq	



GEOKURDISTAN III, Sulaimani 5-7th December 2017



7	Kamal H. Karim ¹ , Mushir M. Baziany ¹ and Polla A Khanaq ²	 ² Student at University of Kurdistan, Hawler, Natural Resource Engineering ¹Department of Geology, College of Science , University of Sulaimani,, ² Kurdistan Institution for Strategic Studies and Scientific Research 	New ideas and critical review of Middle Eocene Gercus Formation, Kurdistan Region, NE- Iraq	sarheng.ahmed88@gmail. com kamal.karim@univsul.edu .iq
8	Faraj Habeeb Tobia ¹ and Sirwa Saeed Shangola ¹	¹ Department of Geology, College of Science- Salahaddin University, Kurdistan Region- Iraq	Geochemistry of sandstones from Beduh Formation (Lower Triassic), Northern Thrust Zone, Kurdistan Region, Iraq: constraints on provenance and tectonic setting	farajabba58@gmail.com
9	Hussein, D ¹ ., Lawrence, J.A ² ., Rashid, F. ³	 ¹ Department of geology, College of Science, University of Suliamani, Kurdistan region, Iraq. ² Department of Civil and Environmental Engineering, Faculty of Engineering, Imperial College, London, UK. ³Oil, gas and energy management department, Charmo University, Kurdistan region, Iraq. 	Pore throat characterization in heterogeneous carbonate reservoirs	<u>dohgeo@gmail.com</u>
10	Ziyad Elias ¹ , Salim H. Suliman Al-Hakari ²	¹ Geomorphic researcher – Hannover - Germany / ² University of Sulaimani, College of Science, Department of Geology	Influence of stream gradient on the fluvial terraces, Greater Zab river, The Iraqi Kurdistan Region	ziyadelias@yahoo.com salim.sulaiman@univsul.e du.iq
11	Chnoor Hoseiny1, Erfan Haji2, Akram Alizadeh3	¹ Geology Department - Urmia University, Urmia- Iran, ² Geology Department - Golestan University, Gorgan-Iran,	Geometrical & Statistical Analysis of the Faults in Kuik – Qoreq Area, South of Sanandaj, Iran	<u>hossini.ch1991@yahoo.co</u> <u>m</u>



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		³ Geology Department - Urmia University, Urmia- Iran.		
12	Tola A. Mirza ¹ Saman Gh.R ² , Stavros P. Kalaitzidis ³	 ¹ University of Sulaimani, Geology Department ² Geoloical Survey and Mineral investigation of Sulaimani ³ Department of Geology University of Patras, Rio- Patras, GR-26504, Greece 	Ore mineralogy, Fluid inclusions and stable isotopes study constraints on genesis of Sharosh sulfide ore mineral, Qandil Series, Iraqi Kurdistan Region	tola.merza@univsul.edu.i g
13	Soran O. A. Kharajiany ¹ and Ibrahim M. J. Mohialdeen ²	¹ Department of Plastic Art, Ceramics, College of Fine Arts, University of Sulaimani, Kurdistan, Iraq ² Department of Geology, College of Science, University of Sulaimani, Kurdistan, Iraq	Nannofossil distribution in the late Jurassic- Naokelekan and Barsarin formations, Miran Oil fields, well- 2-, Kurdistan, Northeastern Iraq	soran.muhammad@univs ul.edu.iq ibrahim.jaza@univsul.ed u.iq
14	Imad M.Ghafor and Ibrahim M.J.Mohialdeen	Department of Geology, College of Science, University of Sulaimani, Sulaimani, Kurdistan, Iraq	Early Cretaceous microfossils associations (Foraminifera, Ostracoda, Calcareous Algae and Coral) from the Garagu Formation, Duhok area, Kurdistan Region, Northern Iraq	imad.gafor@univs ul.edu.iq ibrahim.jaza@uni vsul.edu.iq
15	Rzger A. Abdula ¹ , Mohammed H. Hakimi ² , Lawko A. Ismail ¹ , and Chrokhan T. Mina ¹	 ¹ Soran University, Department of Petroleum Geosciences, Soran, Kurdistan Region, Iraq ² Taiz University, Department of Geology, Ta'izz, Yemen 	Oil–oil correlation in the Kurdistan Region, Iraq: Insights from trace metals studies	<u>rzger.abdula@soran.edu.i</u> <u>g</u>
16	Full text not submitted	1		1
17	Full text not submitted			





18	Fouad M. Qader	Department Geology, College of Science, University of Sulaimani, Sulaimani, Kurdistan Region, Iraq	Reservoir characterization of the Dokan and Gulneri Formations (Upper Cretaceous) from selected wells in Khabbaz Oil Field, Kirkuk area, Northern Iraq	fuad.qadir@univsul.edu.i g
19	Soran O. A. Kharajiany	¹ Soran O. A. Kharajiany,	Calcareous nannotossil	soran.muhammad@univs
	² , Sherwood W. Wise, Ir ² & Basim A Al-	University of Sulaimani, Kurdistan-Irag	stratigraphy of the Upper	<u>ul.edu.iq</u>
	Qayim ¹		sequence from the Dokan section,	
		¹ Basim A. Al-Qayim, Sulaimani, Kurdistan-Iraq,	Sulaimani, Kurdistan- Iraq	<u>basim.alqayim@univsul.e</u> du.ig
		² Sherwood W. Wise, Jr. Florida State University,		
		Tallahassee, Florida, USA,		<u>swise@fsu.edu</u>
20	Rawand Bakir Noori Jaff	Department of General Sciences, College of Basic	Paleogeographic map of Iraq from 750 million years ago to the	rawand.noori@charmoun iversity.org
		Education, Charmo	present	
		Chamchamal, Sulaimani,		
		Kurdistan region, Iraq		
21	Irfan O. Yara, Yousif O.	Department of Geology,	Genesis and metamorphic	<u>varairfan@gmail.com</u>
	Mohhamad	University of Sulaimani,	evolution of iron- copper	
		Region, Iraq	Kurdistan region	
22	Arkan Osman Sharezuri	Faculty of science, Soran	Proposal for Changing the	arkan.osman@hotmail.c
		University	supplementary type locality of the	<u>om</u>
			Naokelekan Formation from Gara	
			section (Gara Village)/ Amadiyah	
			Village)/ Raniya Destrict	
23	Full text not submitted	I	l	l
24	Abdullah Moradi ¹ ,	¹ M.Sc. in oil exploration	Analysis of the stress field and	moradi aba@yahoo.com
	Nazir Anvar Mafakheri	at Imam Khomeini	determining the safe mud window	
	² , Mohammad Nadri ³ ,	International University,	of drilling mud in the southwest of	
	Kilabat Wonammadi	² Lecturer at department	liall	nazir.mafakheri@soran.e
		of petroleum engineering		<u>uu.iq</u>
		Soran University		





		 ³ M.Sc. in oil exploration at Imam Khomeini International University, ⁴ Master of Accounting at Maad University of Sanandaj, Iran 		mohammadnadri86@yah oo.com ziba33@gmail.com
25	Maria-Elli Damoulianou ¹ , Constantinos Perleros ¹ , Ibrahim M.J. Mohialdeen ² , Carla Viviane Araujo ³ , Stavros Kalaitzidis ¹	 ¹ Department of Geology, University of Patras, 26504 Rio-Patras, Greece ² Department of Geology, University of Sulaimani, Sulaimani, Kurdistan ³ Petrobras-Cenpes GEOQ/PDEP, Cidade Universitária-Ilha do Fundão, 21941-915 Rio de Janeiro, Brazil 	Organic petrography and geochemical characterization of Chia Gara Formation in well Miran-2, Kurdistan Region, NE Iraq	<u>skalait@upatras.gr</u> ibrahim.jaza@univsul.edu .iq
26	B. H. Soltan ¹ and S. J. Al-Khafaji ¹	1 Geology department, Collage of Science., Basrah university, Iraq.	Platinum group elements (PGE) and Au geochemistry of peridotite rocks in Mawat and Penjween ophiolite complexes, NE Iraq	<u>Soltanbasim@gmail.com</u> <u>Khafaji52000@yahoo.co</u> <u>m</u>
27	Irfan O. Yara	Department of Geology, University of Sulaimani, Sulaimani, Kurdistan Region, Iraq	Genesis and mineralogy of sulfide mineralization in Korradawi, Kurdistan region	<u>yarairfan@gmail.com</u>
28	Avesta M.Jaff [*] , Azad H. Alshatteri ^{**} , and Hoshmand A.Aziz [*] **Department of Chemistry, College of Education, University of Garmian, Kurdistan		The Effects of Daryan Dam on the Future of Sirwan River in Kelar/Garmian Area/Kurdistan Region of Iraq	azadalshatteri@garmian.e du.krd
29	Mahmood A. M. Al- Mufarji	Department of Applied Geology, College of Science, Kirkuk University	Magnetic Technique for Prospecting Al-Wasiti Archaeological Site, Southern Kirkuk city, Iraq	drmahmoud_2006@ya hoo.com
30	Full text not submitted			
31	Amin-Rasouli ¹ , H.; Haghighat Jou1, N.; Moradi ² , M., Zaheri, Sh. ³	 ¹ University of Kurdistan, Sanandaj, Iran ² Geological Society of Iran ³ Education Organization, Sanandaj, Iran 	Distribution of Secondary Minerals and Trace Elements in Guano Deposits of Karaftu Cave, Kurdistan, Iran	<u>h.aminrasouli@uok.ac.ir</u>

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32	Ayad N. F Edilbi ¹ ., Ali J.Ali. ¹ ,BahjatE.Abdull ah ¹ , Stephen A. Bowden ²	¹ Department of Petroleum Geosciences, Soran University, Soran, Kurdistan Region, Iraq ² Department of Geology and Petroleum Geology, School of Geosciences, University of Aberdeen, Aberdeen AB24 3UE, UK	Source rock evaluation and lateral changes in thermal maturity of the Sargelu Formation (Middle Jurassic) in Kurdistan Region- Northen Iraq	ayad.faqi@soran.edu.iq ayad_nory@yahoo.com
33	Hussein S. Hussein ¹ , Mohammad Ghazi ¹ , and Nabaz Hussein ¹	¹ Department of Petroleum Geosciences, Faculty of Science, Soran University, Erbil.Iraq	Well Log Analysis to Assess the Petrophysical Parameters of the Lower Cretaceous Qamchuqa Formation, Erbil area, Kurdistan Region.	husen4993@yahoo.com
34	Irfan Sh. Asaad ¹ and Sardar M. Balaky ²	¹ Department of Geology, College of Science, Salahaddin University- Erbil, Iraq. ² Department of Petroleum Geosciences, Faculty of Science, Soran University, Soran, Iraq	Microfacies analysis and Depositional Environment of Khurmala Formation (Paleocene- Lower Eocene), in the Zenta Village, Akre District, Iraqi Kurdistan Region	<u>irfan.asaad@su.edu.krd</u> <u>Sardar.balaky@soran.edu</u> <u>.iq</u>
35	Full text not submitted			
36	 Rashid, F*.¹, Hussein, D.², Glover, P.W.J.³, Lorinczi, P.³, Lawrence, J. A⁴. ¹ Oil, Gas and Energy Management Department, Charmo University, Kurdistan region, Iraq. ² School of Earth and Environment, University of Leeds, UK ³ Geology Department, University of Sulaimani, Kurdistan region, Iraq ⁴ Department of Civil and Environmental Engineering, Imperial College London, UK 		Permeability modeling in carbonate reservoir rocks using Magnetic Resonance Measurements	fraidoon.rashid@charmo university.org,
37	Withdraw	·		
38	Rzger A. Abdula ¹ , Sardar Balaky ¹ , Rebwar Khailany ² , Alan Miran ¹ , Choman Muhamad ¹ and	¹ Petroleum Geosciences Department, Science Faculty, Soran University, Iraqi Kurdistan	Sedimentology of Shiranish Formation in Mergasur Area, Iraqi Kurdistan	<u>rzger.abdula@soran.edu.i</u> g

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	Mahmud M.	² Diroctorate of		
	Muhammad ¹	Geological Survey, Erbil,		
		Kurdistan Region, Iraq		
29	Rabeea K. Znad and	Geology Department	The impact of tectonic setting on	dribrahim56@gmail.com
33			distribution of Koloch formation	<u>ansranniso@gnan.com</u>
	ibranim S. Ibranim	/College of Science/Mosul	distribution of Kolosh formation	
	Aljumaily	University	during Paleocene –lower Eocene	
			in northern Irag	
40	Sarkhel Hawre	(^{1,4} University of Miskolc),	Ground water management using	<u>sarkhel.geo@gmail.com</u>
	Mohammed ¹ , Bakhtiar	(^{2,3} University of	hydro-geophysical investigation of	
	Odir Aziz ² . Diary Ali	Sulaimani)	selected field-7aravan area	
	Mohammad ³ Dátar	Salamany	Kurdistan NE Irag	
	Monammed ² , Peter		Kuruistan, NE Iraq	
	Szűcs ⁴			
41	Khalid M. I.	^a Kurdistan Institution for	Planktonic foraminiferal	khalshin@yahoo.com
	Sharbazheri ^a . Polla A.	strategic studies and	biostratigraphy of	
	Khanaga ^a Kamal H	scientific research	Cretaceous/Tertiary boundary in	
	Kerim ^b Imad M	Sulaimani	the Smaguli area. Sulaimani	
		Sulaimani		
	Ghafor ^s , Qahtan A. M.	^b Department of geology	region, Kurdistan, NE Iraq	
	Al Nuaimy ^c			
		University of Sulaimani,		
		Kurdistan		
		(Kielaula Talakainal		
		Institute, Kirkuk		
42	Bayan Ch Thannym ¹	1Domoto Consing Contor	Identification of UC Miero Soonage	azh ar culiman Quniveul a
42		Remote Sensing Center,	identification of HC Micro Seepage	<u>azner.summan@umvsu.e</u>
	and	Mosul University	Using Multi Spectral Image	du.iq
	Ashar Kh. C. Batu?	wosuroniversity	Processing in Takya Area,	
	Aznar Kn. S. Bely	² Department of Geology.	Kurdistan Region – Iraq	
		University of Sulaimani		
43	Omar Qadir Ahmed	Department of Geology,	Earthquake Moment Tensor	dromarseismo@gmail.co
		College of Science,	Analysis Using Broadband Seismic	m
		University of Sulaimani.	Waveforms	
		Kurdistan		
		Kuruistan		
44	Full text not submitted	l		
		Γ.		
45	Omer S. Al-Tamimi ¹	¹ Head of Environmental	Geo-Environmental Evaluation for	<u>omeribrahiem@gmail.co</u>
	and Mustafa J. A. Ali ²	Research Unit, College of	Shewasoor Soil, Kirkuk/ NE Iraq	<u>m</u> 009647731612363
		Science, University of		
		Kirkuk Kirkuk/Irag		mustafa.jamalakbar77@g
				<u>mail.com</u>
		² Master Student at		
		Department of Applied		009647707507118
		Goology College of		
		Science, University of		
		Kirkuk, Kirkuk/ Iraq		
1				



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46	Azealdeen S. Al-Jawadi ¹	¹ Dams and Water	Evaluation of the Bekhme Dam	dribrahim56@gmail.com
	Ibrahem S. Al-Jumaily**	Resources Research	site by the proposed rock mass	
	Dabhagh ²	center-wosur University	strength reduction system	
	Dabbagii	² College of Science-		
		Mosul University		
47	Hazhar H. Ahmed and	Department of	Depositional environments of	amanj.fattah@univsul.ed
	Amanj I. Fattah	Geology/University of	Avanah Formation from selected	<u>u.iq</u>
		Sulaimani	sections, Kurdistan, NE Iraq	
48	Full text not submitted			
49	Dler H. Baban*, Asos S.	Department of	Applications of Quick Look	dler.mohamad@univsul.e
	Abdulla**. and Hasan	Geology/University of	Methods For Evaluating the	<u>du.iq</u>
	N. Omer	ulaimani	Middle Miocene Jeribe Formation	
	wi. Omar	** Department of	From a Selected Well in Jambour	
		Geology/University of	Oilfield, Kurdistan Region-	asos.abdolla@gmail.com
		Sulaimani	Northern Iraq	
		F** KIRKUK OII Training		hsnmaroof59@gmail.com
		nstitute		
50	Dier H. Baban*,	Department of	Application of Flow Zone Indicator	dler.mohamad@univsul.e
	Nonammad D. M. Saeed** and Hasan M	Seology/University of	Hydraulic Flow Units in the Middle	<u>uu.iq</u>
	Omar*	bulannann	Miocene Jeribe Formation From	muhamadgeology@yahoo
	omai	** Directory of Oil and	Selected Wells in Hamrin Oil Field/	<u>.com</u>
		Minerals/Sulaimani	Northern Iraq	hsnmaroof59@gmail.com
		*** Kirkuk Oil Training		
		nstitute		
51	Full text not submitted			
51	Tun text not submitted			
52	Full text not submitted	-		
53	Sabbar Abdullah Saleh	Department of Applied	DEM-GIS Based Geometric	
	Karwan Sardar Husain	Geology, College of	Analyses of Kufri Dam, Kurdistan,	
		Science, University of	Iraq	
		TIKTIT, TIKTIT, Iraq		
		1		

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09:00-10:00	09:00-10:00 Registration						
			Opening Se	ession			
10:00-10:15	Welcome speech						
10.15 11.00	Keynote Speakers: Geology in Kurdist	an University, Sina-Iran: Had	i A. Rasuli, Department	t of Geology, Kurdistan University, Sina-Iran			
10:15-11:00	-Recent Powerful Earthquake Activity	hit Kurdistan Region near to	Irag-Iran Border: Aram	n N. Taufeg, Omer O. Ahmed, Department c	f geology, UOS, and Bak	kir M. Saied. Sulaymaniyah	
	directorate of meteorology and seism	ology/ data center of seismo	ology,		88,,,		
			Coffee B	reak			
	Hall 1			Hall 2		Hall 3	
Session 1	Chair: Dr. Salim H. Sulaiman	Secretary: Dr. Ziad Flias	Chair: Dr. Kamal H Karim	Secretary: Dr. Mushir M Baziany			
	GK3-1 The lateral growth of Qaradagi	h Anticline, A tectonic-	GK3-41 Planktonic for	aminiferal biostratigraphy of			
	geomorphological study, South of Sula	aimani city, Kurdistan	Cretaceous/Tertiary b	ooundary in the Smaquli area, Sulaimani			
11:30-12:00	Region, Iraq Varoujan K. Sissakian, R	ahim M. Amin and Jamal	region, Kurdistan, NE	Iraq Khalid M. I. Sharbazheri, Polla A.			
	Gh. Mohammed		Khanaqaa, Kamal H. I Nuaimy	Karim, Imad M. Ghafor, Qahtan A. M. Al			
	GK3-2 Indicating the Tectonic Activity of Kifri Chai Basin, Using		GK3-13 Nannofossil distribution in the late Jurassic- Naokelekan				
	Geomorphological Indices, the Kurdistan Region, NE Iraq		and Barsarin formations, Miran Oil field, well-2-, Kurdistan, NE				
12:00-12:30	Ziyad Elias and Varoujan K. Sissakian		Iraq				
			Soran O. A. Khai	rajiany and Ibrahim M. J. Mohialdeen			
			Luncl	ņ	-		
Session 2	Chair:	Secretary:	Chair:	Secretary:	Chair:	Secretary:	
	Dr.Amanj I. Fattah	Dr. Rawand Jaff	Dr.Basim Al-Qayim	Dr. Fuoad M. Qader	Dr.Diary A. Mohammd	Dr. Arsalan A. Othman	
	GK3-7 New ideas and critical review of Middle Eocene		GK3-9 Pore throat characterization in heterogeneous		GK3-28 The Effects of	Daryan Dam on the Future of	
14:00-14:30					Sirwan River in Kelar/G	armian Area/Kurdistan Region	
1100 1100	Kamal Haji Karim, Mushir M. Baz	iany and Polla A Khanaq	Hussein, D., Lawrence, J.A., and Rashid, F.		of Iraq Avesta M.Jaff, Hoshmand A Aziz	Azad H. Alshatteri, and	
	GK2-21 Distribution of Secondary Mi	inerals and Trace Flements					
	in Guano Deposits of Karaftu Cave. K	urdistan. Iran	GK3-18 Reservoir cha	racterization of the Dokan and Gulneri	GK3-40 Ground water i	management using hydro-	
14:30-15:00	Amin-Rasouli , H.; Haghighat Jo	u., N.; Moradi, M., and	Formations (Upper Cr Oil Field, Kirkuk area	retaceous) from selected wells in Khabbaz Northern Irag	geophysical investigationarea. Kurdistan, NE Irao	on of selected field-Zarayan	
	Zaheri, Sh).			Sarkhol H. Mahami	nod Pakhtiar O Aziz Dianu	
			Fouad M. Qader		A.Mohamm	ied, and Péter Szűcs	
	GK3-39 The impact of tectonic setting	g on distribution of Kolosh	GK3-36 Permeability	modeling in carbonate reservoir rocks	GK3-53 DFM-GIS Base	d Geometric Analyses of Kufri	
15.00 15 33	formation during Paleocene –lower E	ocene in northern Iraq	using Magnetic Resor	using Magnetic Resonance Measurements			
15:00-15:30	Rabeed R. 2nau and ibranim S. and ibranim Aljumally		Lawrence, J. A.		Sabbar A. Sale	eh and Karwan S. Husain	

Day 2

	Hall 1		Hall 2		Hall 3		
Session 3	Chair: Dr.Rzger Abdula	Secretary: Dr.Abdula Moradi	Chair: Dr.Tola A. Mirza	Secretary: Dr Yousif O. Mohamed	Chair: Dr. Ibrahim Al-Jumaily	Secretary: Dr. Azhar Bety	
09:00-09:30	GK3-45 Geo-Environmental Evaluation for Shewasoor Soil, Kirkuk/ NE Iraq Omer S. Al-Tamimi and Mustafa J. A. Ali		Gk3-27 Genesis and mineralogy of sulfide mineralization in Korradawi, Kurdistan region Irfan O. Yara		GK3-4 Slope stability of Darbendikhan dam and near surroundings. A reconnaissance study study, Kurdistan region, NE Iraq Varoujan K. Sissakian, Sakar A. Sdiq and Govar K. Haris		
09:30-10:00	GK3-15 Oil–oil correlation in the K Insights from trace metals studies Rzger A. Abdula, Mohammed H. Chrokhan T	urdistan Region, Iraq: Hakimi, Lawko A. Ismail, and ⁻ . Mina	GK3-12 Ore mineralogy, Fluid inclusions and stable isotopes study constraints on genesis of Sharosh sulfide ore mineral, Qandil Series, Iraqi Kurdistan Region Tola A. Mirza, Saman Gh.R, and Stavros P. Kalaitzidis		GK3-6 Assessment of Dukan landslides, a case study, D dam reservoir, west of Sulaimani city, Kurdistan region Varoujan K. Sissakian, Diyar S. Mohamed and Sarl Ahmed		
10:00-10:30	GK3-25 Organic petrography and characterization of Chia Gara Forr Kurdistan Region, NE Iraq Maria-Elli Damoulianou, Constar Mohialdeen, Carla Viviane Arad	geochemical mation in well Miran-2, ntinos Perleros, Ibrahim M.J. ujo, and Stavros Kalaitzidis	GK3-21 Genesis and metamorphic evolution of iron- copper mineralization in Mirawa, Kurdistan region Irfan O. Yara and Yousif O. Mohhamad		GK3-46 Evaluation of the Bek rock mass strength reduction Azealdeen S. Al-Jawadi, Thanoon H	hme Dam site by the proposed system Ibrahem S. Al-Jumaily and I. Al-Dabbagh	
10:30-11:00	GK3-32 Source rock evaluation an maturity of the Sargelu Formation Kurdistan Region- Northen Iraq Bahjat E. Abdullah, and Stephen	nd lateral changes in thermal n (Middle Jurassic) in Ayad N. F Edilbi., Ali J.Ali., A. Bowden	GK3-26 Platinum group elements (PGE) and Au geochemistry of peridotite rocks in Mawat and Penjween ophiolite complexes, NE Iraq B. H. Soltan and S. J. Al-Khafaji		GK3-11 Geometrical & Statis Kuik – Qoreq Area, South of S Chnoor Hoseiny, Erfan	tical Analysis of the Faults in Sanandaj, Iran Haji, and Akram Alizadeh	
Coffee Break							
Session 4	Chair: Dr. Dler Baban	Secretary: Dr. Divan Osman	Chair: Dr.Khalid M. Sharbazheri	Secretary: Dr.Ayad Edilbi	Chair: Dr. Faraj H. Tobia	Secretary: Dr. Omer Q. Ahmed	

11:30-12:00	GK3-49 Applications of Quick Look Methods For Evaluating the Middle Miocene Jeribe Formation From a Selected Well in Jambour Oilfield, Kurdistan Region-Northern Iraq Dler H. Baban, Asos S. Abdulla, and Hasan M. Omar		GK3-34 Microfacies analysis and Depositional Environment of Khurmala Formation (Paleocene-Lower Eocene), in the Zenta Village, Akre District , Iraqi Kurdistan Region Irfan Sh. Asaad and Sardar M. Balaky		GK3- 8 Geochemistry of sands (Lower Triassic), Northern Thr Iraq: constraints on provenan Faraj H. Tobia and	stones from Beduh Formation rust Zone, Kurdistan Region, ce and tectonic setting d Sirwa S. Shangola
12:00-12:30	GK3-33 Well Log Analysis to Assess the Petrophysical Parameters of the Lower Cretaceous Qamchuqa Formation, Erbil area, Kurdistan Region Hussein Suad Hussein, Mohammad Ghazi, and Nabaz Hussein		Gk3-38 Sedimentology of Shiranish Formation in Mergasur Area, Iraqi Kurdistan Rzger A. Abdula, Sardar Balaky, Rebwar Khailany, Alan Miran, and Choman Muhamad and Mahmud M. Muhammad		GK3-43 Earthquake Moment Broadband Seismic Waveforr Omar Q	Tensor Analysis Using ns adir Ahmed
12:30-13:00	 GK3-50 Application of Flow Zone Indicator Method to Determine the Hydraulic Flow Units in the Middle Miocene Jeribe Formation From Selected Wells in Hamrin Oil Field/ Northern Iraq Dler H. Baban, Mohammad B. M. Saeed, and Hasan M. Omar 		GK3-22 Proposal for Changing the supplementary type locality of the Naokelekan Formation from Gara section (Gara Village)/ Amadiyah Destrict to Duawa section (Duawa Village)/ Raniya Destrict Arkan Osman Sharezuri		Gk3-24 Analysis of the stress field and determining the safe mud window of drilling mud in the southwest of Iran Abdullah Moradi, Nazir Anvar Mafakheri , Mohammad Nadri and Khabat Mohammadi	
			Lunch			
Session 5	Chair: Dr. Haddi A. Rasouli	Secretary: Dr. Rawand b. Jaff	Chair: Dr. Imad M. Gafor	Secretary: Dr. Rayan Gh. Thannoun	Chair: Dr. Aram N. Taufeq	Secretary: Dr. Faraidon N. Rashid
14:30-15:00	GK3-5 Factors Controlling The Dev Forms In The Mountains Of The Ku Varoujan K. Sissakian, Arsalan Shihat	relopment Of Wine Glass urdistan Region, Iraq A. Othman and Ahmed T. D	Of Wine Glass GK3-42 Identification of HC Micro Seepage U gion, Iraq Spectral Image Processing in Takya Area, Kurd and Ahmed T. Rayan Gh. Thannoun and Azhar Kh. S		GK3-47 Depositional environr from selected sections with ir folded zones, Iraq Hazhar Ahmed a	nents of Avanah Formation I Zagros high and Zagros low and Amanj I. Fattah
15:00-15:30	415:30 Gk3-10 Influence of stream gradient on the fluvial terraces, Greater Zab river,The Iraqi Kurdistan Region Ziyad Elias and Salim H. S. Al-Hakari		GK3-14 Early Cretaceous microfossils associations(Foraminifera, Ostracoda, Calcareous Algae and Coral)from the Garagu Formation, Duhok area, Kurdistan Region, Northern Iraq		GK3-29 Magnetic Technique for Prospecting Al-Wasiti Archaeological Site, Southern Kirkuk city, Iraq Mahmood A. M. Al-Mufarji	

15:30-16:	Gk3 ago	Gk3-20 Paleogeographic map of Iraq from 750 million years ago to the present Rawand Bakir Noori Jaff			GK3-19 Calcareous nannofossil stratigraphy of the Upper Cretaceous –lower Paleocene sequence from the Dokan section, Sulaimani, Kurdistan- Iraq Soran O. A. Kharajiany, Sherwood W. Wise, Jr. and Basim A. Al-Qayim			
Closing Session Chair: Dr. Polla A. Khanaqa				Chair: Dr. Polla A. Khanaqa		Secretary: Dr. Diary A. Mohammed		Member: Dr. Hawkar Bapir
	16:00-17:30 Discussion and Recommendations							





The lateral growth of Qara Dagh Anticline, a tectonic-geomorphological study, South of Sulaimaniyah city, Kurdistan Region, Iraq

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Abstract

Qara Dagh anticline is within the High Folded Zone of the Zagros Fold – Thrust Belt, in the Outer Platform of the Arabian Plate. It is located south of Sulaimaniyah city in NW – SE trend, its length is about 117 Km. The oldest exposed rocks in the anticline are Paleocene in age belong to the Kolosh Formation; however, the limestones of the Sinjar Formation form the both flanks of the Qara Dagh Mountain, which represents Qara Dagh anticline. Locally, the Pila Spi Formation forms the carapace of the mountain giving whale-back nature to the anticline.

Many water and wind gaps are present in Qara Dagh anticline; witnessing the lateral growth of the anticline. We conducted a tectonic – geomorphological study depending on the existing features and forms in the anticline; using different types of satellite images with different scales. Moreover, we used the updated geological maps at scale of 1:100000 to indicate structural, geomorphological and stratigraphic data and the behavior of the limbs of the anticline; structural wise.

From the conducted study, we concluded that Qara Dagh anticline was consisting originally of six small anticlines that exhibited lateral and vertical growth leading to one major anticline. The six segments are called Hanjira, Basara, Sagerma, Zarda, Spei and Golan; from northwest to southeast.





Indicating the Tectonic Activity of Kifri Chai Basin, Using Geomorphological Indices, the Kurdistan Region, NE Iraq

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<u>Abstract</u>

The Kifri Chai Basin includes four anticlines, Kalar, Pulkhana, Qumar and Gilabat; all are NW – SE oriented; however, in the extreme northern part, Chia Surkh anticline crosses the basin. They also exhibit thrusting; where the northeastern limb is thrusted over the southwestern one leading the disappearance of the latter limb and the anticlinal axes. The Bai Hassan, Mukdadiya, Injana and Fatha formations are exposed in the studied basin. The main rock constituents are fine clastics and coarse conglomerate; except the constituents of the Fatha Formation, which includes marl, claystone, limestone and gypsum. Many ridges exist in the studied area; mainly due to the thrust faults and thick conglomerate beds.

The aim of this study is to deduce the tectonic activity of Kifri Chai Basin using geomorphic indices. The used geomorphic indices include the following: 1) Stream-gradient Index (SL), 2) Asymmetric Factor (Af), 3) Hypsometric Integral (Hi), 4) Ratio of Valley Floor Width to Valley Height (Vf), 5) Basin Shape Index (Bs) and 6) Mountain Front Sinuosity Index (J).

The Active Tectonic Index (*Iat*) is indicated by using the six measured geomorphic indices; consequently, the tectonic activity of the studied basin is deduced.

After calculating the geomorphic indices and indicating the *Iat* in the studied area; following the *Iat* classification, which includes four main classes: Very high, High, Moderate and Low active tectonic areas, we have indicated the activity of the studied sub-basins.a We have used the DEM and other relevant images with an ArcGIS program to indicate the tectonic activity of Kifri Chai Basin, and we have found that the tectonic activity in the whole basin is **Moderate**, with average *Iat* value of **2.23** of **Class 3**.





Slope Stability of Darbendikhan Dam and near surroundings. A reconnaissance study, the Kurdistan Region, NE Iraq

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<u>Abstract</u>

Darbendikhan Dam is constructed on the Sirwan (Diyala) River during 1955- 1961. The dam is of earth fill type with concrete spill ways and gates for electric power generation. The dam axis is almost E - W with both left and right abutments being constructed within the Gercus Formation, which consists of red clastics with more claystones. The Gercus Formation is overlain by the Pila Spi Formation that consists of hard to very hard, well bedded carbonates. The Pila Spi Formation is overlain by the Fatha Formation that consists of thick reddish brown claystones alternated with thin gypsum and limestone beds.

Both Gercus and Fatha formations form steep to very steep slopes on upstream and downstream, respectively. All the slopes on the dam site and near surroundings suffer from different types of mass movements with different sizes. Some of them are old and dormant; others are recent and active exhibiting geological hazards, which may cause large loss of human life and the existing properties and infrastructure.

We studied the slopes using different types of satellite images with different resolutions and conducted field trips to the dam site to collect data. We recommended some precautions to make the slopes more stable.





GK3-5 Factors controlling the Development of Wine glass forms in the mountains of the Kurdistan Region, Iraq

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Abstract

The northern parts of Iraq; the Kurdistan Region is a mountainous area with raged topography and relief difference that attains up to 2500 m and more. Among the main erosional – morphological forms that are intensely developed are the wine glass (erosional cirques) forms. They are developed in different shapes, sizes and depths; as well the number of the outlets. In the outlets of the wine glass forms; usually alluvial fans are formed in the adjoining flat and/ or gently sloping areas.

The studied area is characterized by the presence of long and narrow anticlines with NW–SE trend that changes westwards to E–W trend. The Cretaceous carbonate rocks form the main carapace of the majority of the mountain; however, locally Paleogene and/ or Jurassic rocks form the carapace of the mountains. In the core of anticlines, rocks down to Devonian are exposed; however, mainly Jurassic and rarely Triassic rocks are exposed in the cores. In those anticlines where only Cretaceous rocks are exposed, no or very rarely wine glass forms are developed.

This is attributed to the Cretaceous rocks, especially the carbonates, which exist in huge thicknesses in many formations, with thickly bedded to massive nature and very hard erosion resisting rocks. Among the concerned formations are Qamchuqa and Bekhme; both form the main carapace of the mountains and/ or the outer limbs of the anticlines.

We have studied tens of the existing wine glass forms to indicate the factors that control their development. To perform the aim of this study, we have used different satellite imagery with different resolutions; besides using GIS technique and field check to improve the acquired date.





Assessment of Dukan landslides. a case study, Dukan dam reservoir, West of Sulaimaniyah city, the Kurdistan Region, Northeast Iraq

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 ² Student at University of Kurdistan, Hawler, Natural Resource Engineering Corresponding author: <u>varoujan49@yahoo.com</u>

Abstract

Four landslides of different sizes had occurred in 2012 along the main paved road between Dukan – Surdash. The landslides are within the Kometan Formation, which consist mainly of well bedded and jointed marly limestone. The landslides are located in a narrow syncline trending NW – SE in between Khalikan and Kalo anticlines.

The main reason of the landslides is the haphazard road cuts during the road construction and widening of the road latter on. Another reason that had accelerated the landslide is the fluctuation of water level in Dukan reservoir. The water level reaches the down slope area of the landslides.

We have used satellite imagery to study the parameters of the landslides and have performed a field work to confirm the acquired parameters and deduce other indications of the landslides, besides checking their stability. We performed Landslide Possibility study using Landslide Possibility Index at each landslide area and have found that the whole area is unstable showing High possibility of refailure. We also used stereographic presentation for the first three landslides to show the relation between bedding and joint planes as well the road cuts trends. Therefore, we believe in next rainy season, the whole area may form a severe geological hazard if necessary precautions are not considered. We also have recommended urgent precautions to keep the slopes alongside the road cur as stable as possible.





New ideas and critical review of Middle Eocene Gercus Formation, Kurdistan Region, NE-Iraq

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<u>Abstract</u>

In Iraq, Gercus Formation (Middle Eocene) is exposed now near boundary between Low and High Folded Zone and generally consists of the red claystone and sandstone with ocassional beds of conglomerate. Lithologically, it changes toward the southwest to carbonate-siliclastics of either Khurmal or Aliji Formations inside the Low Folded Zone. The formation has variable thickness which ranges between 30 to 800 meters. The highest thickness is existing in areas where Khurmala (or Sinjar) Formation facies changed to Gercus Formation. All the studies before 2013 have concluded that the environment of the formation was fluvial and deltaic of continental mollasse facies with possible some shallow marine sediments at its lower part. Conversely, the most recent two studies have assigned two different and opposite environments to the formation, which are deep marine (turbidite facies) and desert environments. The aim of the present study is critical and objective analysis of the previous studies and introduction of new ideas that are opposite to deep marine and eolian environments. The study gives many evidences and features for justification of the introduced new ideas which are revealing the actual environment of the formation. This indication is depended on the field and regional correlation in areas of boundary between High and Low Folded Zone (area of exposure of Gercus Formation) and area of Imbricated and Thrust Zone where its equivalent in age and facies (unit five of Red Bed Series) is exposed. The present study supports neither the deep marine turbidite nor the desert erg system of the previous studies. The present study proves that the Gercus Formation is consisting of the distal alluvial fan and its proximal part is unit five of Red Bed. The prevalence of fine red clastics (claystone and siltstone) and variable bed colors doesn't agree with deep marine and desert environments.





Geochemistry of sandstones from Beduh Formation (Lower Triassic), Northern Thrust Zone, Kurdistan Region, Iraq: constraints on provenance and tectonic setting

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Abstract

Petrographic, major, trace, and rare-earth element data for the sandstone of the Beduh Formation, Northern Thrust Zone, Kurdistan Region, were analyzed to constrain their provenance, weathering, and tectonic setting during the Lower Triassic. The chemical index of alteration (CIA), chemical index of weathering (CIW), and plagioclase index of alteration (PIA) values and the A-CN-K diagram revealed moderate weathering in the source region. The index of chemical variability (ICV) suggests compositionally immature and non steady-state weathering conditions probably due to the intensity of tectonic activity in the source area. A statistically significant correlation observed between total rare earth elements (ΣREE) versus Al2O3 and Zr indicated that REE are mainly housed in detrital minerals. Petrographic study, microchemistry of heavy minerals, REE patterns, Eu/Eu* anomalies, chemical ratios ((La/Lu)n, Th/Co, Cr/Th, and La/Co) and the diagrams (TiO2 vs. Ni; La/Th vs. Hf) indicate the study sandstone was likely derived from felsic with some effect of intermediate source rocks (igneous and metamorphic). Tectonic discrimination diagrams (SiO2 vs. K2O/Na2O, TiO2 vs. Fe2O3+ MgO, and DF1 vs. DF2) based on major elements, multi-element patterns, REE characteristics, and diagnostic trace element ratios (Ti/Zr, (La/Sm)n) imply that the tectonic setting of the source area was a passive margin and active continental margin; the former confirm with the Arabian Shield and Rutba Uplift and the latter with the volcanic activity at Lower Triassic.





Pore Throat Characterization in Heterogeneous Carbonate Reservoirs

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Abstract

The main heterogeneities in carbonate reservoirs are characterized by variable pore connectivity, pore throat size and pore types. These elements of variability can be associated with geological environments and diagenetic overprints during or after deposition. Pore throat size, which controls fluid flow in reservoir rocks, is rarely established in heterogeneous carbonates, and in carbonate reservoirs complex pore networks occur compared to sandstone reservoirs. In carbonate reservoirs different porosity types and pore sizes are recognized, thus it is crucial to identify a representative pore throat radius for the carbonate reservoir. This study investigated how pore throat size can be estimated in heterogeneous carbonate reservoirs, distinguishing examples of porous carbonates versus tight carbonates. Through this investigation a multilinear regression method is applied to the characterization of pore throat size in heterogeneous carbonate rocks using petrophysical porosity and permeability data sets; results were then compared to the pore throat size curve distributions derived from mercury injection analyses. The relationships between porosity, permeability and different elements obtained from mercury injection capillary pressure curves were obtained from tests on 23 carbonate samples. A series of empirical relationships were determined describing the relationships between pore throat size, porosity and permeability for the porous and for the tight carbonate samples. These relationships predicted that a pore throat radius corresponding to mercury saturation of displacement pressure () produces the best correlation coefficient for pore throat radius, for the highly porous samples, and mercury saturation at threshold pressure () produces the best correlation coefficient for the tight carbonates. This work shows that empirical equations can be derived for reservoir carbonates and used to estimate permeability, especially useful in un-cored intervals.





Influence of stream gradient on the fluvial terraces, Greater Zab river, The Iraqi Kurdistan Region

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Abstract

The study area lies in the Lower and Higher Folded Zones of the Iraqi Kurdistan. It is located between Aqra Mountain and Serat foothill. The course of the Greater Zab River crosses several tectonic blocks from Aqra anticline before entering to the south Sera foothill. The aim of this study is to show the influence of stream gradient on the morphology of the terraces on the right and left banks of the river in the study area. The gradient of rivers shows higher value in their lower sections than in the upper sections.

The levels of the terraces are classified into right and left side along the river's channel. The higher terraces in the upper section are related to paleo-environment flood and tectonic, while the higher terraces in the lower section are related to Serat foothill's uplift and tributaries of the Greater Zap River. Terraces forming the river may have been prependicular to the profile line in the right upper section, causing these terraces steeper in the profile than terraces formed where the river flowed parallel to the profile line in the lower section. Asymaterical tributary has also impact on both sides of the terraces. River valley is adjusted to the tectonics in the lower parts by building of fluvial deposits in the north range of Serat foothill, especially in the right side.

Keywords: Stream gradient, longitudinal profile of terraces, SRTM, Greater Zab River, Iraq





Geometrical & Statistical Analysis of the Faults in Kuik – Qoreq Area, South of Sanandaj, Iran

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Abstract

Studying geometrical and statistical characteristics is an important part of structural analysis. The study area is part of Sanandaj-Sirjan zone (SSZ), the metamorphic belt of Zagros Orogen, western Iran. First, structural map of the study area was prepared based on both the RS-based lineaments map and field observations. Then the lineaments were grouped to 3 sets by their length values as Major, Main and Minor. Length values of the study area exponentially decrease by increasing their frequency which indicates that they have been well developed. In the next step, Intensity and density factors were calculated which shows concentration of high values in Central South and Southern West; that demonstrating that the fault systems in Kuik-Qoreq region have spread out in the two foregoing parts. Finally, the rose diagrams show 3 main trends of NNE-SSW, WNW-ESE & ENE-WSW. I and P values are mostly related to the south and SW of the area. Tectonic evolution by the brittle structures have been reached to its final stages; but fracture development is continuing now.

Keywords: RS Methods, Geometrical analysis, Statistical analysis, Kinematic analysis, Fault Classification, Kuik- Qoreq area, Sanandaj-Sirjan Zone





Ore mineralogy, Fluid inclusions and stable isotopes study constraints on genesis of Sharosh sulfide ore mineral, Qandil Series, Iraqi Kurdistan Region

Tola A. Mirza¹ Saman Gh.R², Stavros P. Kalaitzidis³

1 University of Sulaimani, Geology Department 2 Geoloical Survey and Mineral investigation of Sulaimani ³ Department of Geology University of Patras, Rio-Patras, GR-26504, Greece

Abstract

Sharosh metalized quartz veins located near Sharosh village in Qandil range locality of about 30 km north-northwest of Qaladiza town where hosted in Cretaceous marble and phyllite rocks. The quartz veins included sulfide and oxide ore minerals which are mostly occur in form of open space filling texture. The polymetallic mesothermal quartz veins are hosted by marble and phyllite rocks. Within these veins, multiphase, open space filling and crustiform, bedding to massive textures with pyrite, sphalerite, galena, chalcopyrite,galena, sphalerite,Gerriite, tenorite, azurite, and malachite are observed. Selected samples were analyzed by using ore microscopy and Electron Probe Micro Analyzer (EPMA) and Scanning Electron Microscope (SEM). Ore minerals show replacement textures. The paragenesis diagram was made from a careful study of polished sections and three stages have been identified includes pre stage mineralization, Mineralization and post mineralization stages.

Six samples of the metallized quartz selected for fluid inclusion microthermometric analysis with two samples of sulfide ore minerals for sulfur stable isotope. Fluid inclusion microthermometric analysis of 15 primary inclusions of quartz veins indicated that ore mineralization at Sharosh were formed by a mesothermal, low to medium density, and dilute NaCl type fluid system. The source of the fluid mostly metamorphic which became mixture with other fluids later. Hydrothermal fluids of the Sharosh area classified into two groups based on microthermometry study, first group had higher homogenization temperature (335.5 to 386.8 °C) than second group (194.1 to 298.5 °C), with small difference in salinity between them, nearly each groups have different complexes included chloride and sulfide complexes respectively. The results of stable sulfur isotope of the ore minerals (chalcopyrite and sphalerite) confirmed on the sedimentary and/or metamorphic origin of the ore mineralization. The oxygen and carbon isotope data indicate that the hosted marble have the sedimentary carbonate origin.

Keywords: Metallized quartz veins, Mesothermal, Hydrothermal fluids, Stable Isotope.





Nannofossil distribution in the late Jurassic- Naokelekan and Barsarin formations, Miran Oil fields, well-2-, Kurdistan, Northeastern Iraq

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Abstract

The Naokelekan and Barsarin formations of the late Jurassic time are studied in the oil well Miran -2- at the Sulaimani area of Kurdistan. This study is focused on the determination of nannofossil contents and the ages of both rock units, based on the nannofossil marker species. Twelve cutting samples are selected from both formations in that well for this study. The sample lithology of the Naokelekan Formation is dominated by black shale, and some white rock fragments, while the lithology of the Barsarin Formation is characterized by high abundance of dark- grey and grey limestone towards bottom, whereas the ratio of milky- white limestone is increased upward. The nannofossil species that identified for the first time here are Conusphaera mexicana, Polycostella senaria, Nannoconus compressus, Helenea staurolithina, Watznaueria britannica, Watznaueria barnesiae, Lotharingius hauffii, Faviconus multicolumnatus and Parhabdolithus robustus. These assemblage are persisted late Jurassic; the index nannofossils and biostratigraphic zonation of these calcareous nannofossil are indicated that the age of Barsarin Formation dates back to Tithonian and Naokelekan Formation to late Kimmeridgian- Tithonian. The contact between both formations is gradational according to the biostratigraphic zonation of the calcareous nannofossils. Preservation of the nannofossils in the well is bad to moderate and the calcite grains are re-crystallized and dolomitized, which in turn made the identification difficult.

Keywords: Naokelekan, Barsarin, Jurassic, Calcareous nannofossils, *Conusphaera mexicana, Nannoconus compressus, Polycostella senaria,* Miran Oil Field, Sulaimani, Kurdistan, Iraq





Early Cretaceous microfossils associations (Foraminifera, Ostracoda, Calcareous Algae and Coral) from the Garagu Formation, Duhok area, KurdistanRegion, Northern Iraq

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Abstract

Microfossils from an outcrop of the Garagu Formation at Gara Mountain, Duhok Governorate, Kurdistan Region, Northern Iraq, indicates a shallow marine, shelf lagoonal environment and open platform. Twenty samples were collected from unbroken succession of the Garagu Formation. The thickness of the succession is 89.9m and it consists mainly of different colored limestone beds with different fauna contents. The lower boundary with a gradational and conformable nature is with Chia Gara Formation (Tithonian-Berriasian,) and the upper boundary is gradational with Sarmord Formation (Valanginian-Aptian). The microbiota associations are mostly composed of species of foraminifera, ostracods, calcareous algae and coral, with dissociated elements and skeletal fragments of gastropods, pelecypods, bryozoans, sponge spicules, crinoid debris and echinodermata spines. Sixty species are recorded in this study; the combined stratigraphic ranges of the microfossil species identified from the studied section of the Garagu Formation support an age determination of the Late Valanginian-Barremian.

Keywords: Microfossils, Garagu Formation, Early Cretaceous, Systematic Description, Duhok, Kurdistan, Iraq





Oil-oil correlation in the Kurdistan Region, Iraq: Insights from trace metals studies

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Abstract

A collection of 11 crude oil samples from 11 oil exploratory wells throughout 5 oilfields in the Northern Mesopotamian Basin were recognized. Concentrations of trace metals and sulfur of all crude oil samples from Guwear, Kirkuk, Tawke, Khurmala, and Taq Taq oil fields were determined by using Spectroil M/F Spectrometer. The mean values of vanadium and nickel trace metals were 20 and 15 ppm, respectively.

Trace metals configurations and constraints were helped to explore the palaeoenvironmental and depositional environments and to group the oils geochemically. Additionally, the problems that arise from existing trace metals in petroleum within the oil industry were studied.

Keywords: Crude oil, Trace metals, Oil-oil correlation, Depositional environment, Iraqi Kurdistan







Reservoir characterization of the Dokan and Gulneri Formations (Upper Cretaceous) from selected wells in Khabbaz Oil Field, Kirkuk area, Northern Iraq

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Abstract

The Cretaceous Dokan and Gulneri Formations have been studied from reservoir characterization point of view in Khabbaz Oil Field/ Northern Iraq. The Cinemanian Dokan Formation is an open marine oligosteginal limestone ranged in thickness between 21 to 29 meters in this field, and it is overlain by thin bed (11-14m) of Gulneri Shale Formation, and they underlain by a thick rock unit represented by Qamchuqa Formation (Mauddud and Shu'aiba)

The available detail log data for the seven wells (Kz-1, Kz-3, Kz-4, Kz-5, Kz-11, Kz-14, and Kz-16) in addition to some general data derived from wells (Kz-2, Kz-6, Kz-7, Kz-8, Kz-9, Kz-10, Kz-12, Kz-15, and Kz-21), these data have been used in characterizing the reservoir properties of the studied formations. The detected lithologies from porosity logs showed domination of limestone in Dokan Formation, and shale command for Gulneri. Clay content has been calculated from gamma ray log along the studied sections. The porosity measured from sonic, density, and neutron logs, primary and secondary porosities have been calculated and finally fracture index indicated. From Neutron – Density Crossover the gas zone was indicated





Calcareous nannofossil stratigraphy of the Upper Cretaceous –lower Paleocene sequence from the Dokan section, Sulaimani, Kurdistan- Iraq

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Abstract

The boundary of the Cretaceous/Tertiary in the Kurdistan region of Iraq is still debatable. Most previous studies consider the Danian sediments to be absent. This paper examines the boundary at the Dokan area to the northwest of the Sulaimani city of Kurdistan region of the north Iraq. This research analyzed calcareous nannofossil assemblages and the biostratigraphy of the boundary.

The sequence in the studied section is characterized by alternations of olive green to greenish gray sandstone, siltstone, shale and marlstone of the Tanjero Formation of the late Campanian-Maestrichtian and the overlying Kolosh Formation of the early Paleocene. The upper part of the section includes thick sandstone beds and a reworked bioclastic conglomerate bed in addition to the dark- grey silty calcareous shale.

The study shows that deposition across the boundary is continuous. The boundary is biostratigraphically delineated by the last occurrence of Maastrichtian taxon and the first occurrences of Biantholithus sparsus, Cruciplacolithus spp. and Coccolithus pelagicus of biozone NP1, which indicate no hiatus. This succession approves the occurrence of the early Danian sequence at the bottom of the Kolosh Formation.

Keywords: Dokan, K/T boundary, early Danian, NP1, Biantholithus sparsus, Tanjero, Kolosh, Sulaimani, Kurdistan/Iraq




Paleogeographic map of Iraq from 750 million years ago to the present

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Abstract

Thirty five plates tectonic reconstructions are presented that illustrate the movement of the continents since the Late Precambrian about 750 million years ago. Plate tectonic reconstructions older than 200 million years are fundamentally more hypothetical and were derived by combining diverse lines of evidence from the tectonic histories of the continents. The reconstructions of the past position of the continents were based on five main lines of evidence: 1) magnetic anomalies produced by sea floor spreading; 2) paleomagnetism; 3) hotspot tracks; 4) Lithologic indicators of climate; 5) the geologic record of plate tectonic history. The position of Iraq on a global map from 750 million years ago to the present was shown on each thirty five plate tectonic reconstructions. It has been noticed that Iraq continuously changed its positions in a clockwise direction from near to North Pole in Middle Cryogenian (about 750 million years ago) to near to East Equator in Neoproterozoic-Ediacaran (about 600 million years ago) with very cold paleoclimate conditions. During the early Palaeozoic (about 530 million years ago), elevated levels of atmospheric CO2 caused warmer paleoclimate conditions (Including Iraq). During the Carboniferous period (about 305 million years ago), a large ice age and continued well into the Permian began. Additionally, sea levels were at that time falling, and presumably a lowering of CO2 as all the continents began to converge. In Late Triassic-Carnian and Triassic/Jurassic boundary (about 220 and 200 million years ago) arid and warm conditions (including Iraq) were recognized for the globes were hotspot tracks and sea floors spreading were used to constrain the longitudinal position of the continents. From geological evidence, it appears that the suggested warmth of the Triassic and Jurassic periods continued well into the Cretaceous (about 136 to 65 million years ago). The early Eocene (about 55 to 50 million years ago) was the warmest period during the Cenozoic. It has been suggested that the early Eocene warming may have resulted from an increase in atmospheric CO2, due to a significant reorganization in tectonic plate motion. During the late Eocene and Oligocene Epochs (40 to 25 million years ago) a transition paleoclimate occurred between the warm periods of the early Cenozoic and the cold periods of the





later Cenozoic. In Late Miocene (about 20 million years ago) the positions of continents were similar to where they lie today with significant cooling conditions.

Keywords: PALEOMAP Project, sea floor spreading, hotspots, paleomagnetism, paleoclimate, Iraq





Genesis and metamorphic evolution of iron- copper mineralization in Mirawa, Kurdistan region

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Abstract

Mirawa iron- copper mineralization in Mirawa, Kurdistan region, occurs as a zone of 15 m thickness within the gabbro of the Mawat Ophiolite. It is hosted by brecciated amphibolite facies gabbroic rocks within and adjacent to a north-west–south-east trending shear zone. Amphibole (Am), magnetite (mg), plagioclase (pl 1), quartz (qtz), epidote (ep), chlorite (chl), clinopyroxene (clpx) and chalcopyrite (chp) are represented in the mineral assemblage of amphibolite. Metamorphic history can be seen from the formation of/in the formation of green amphibole replacing clinopyroxene (D1, 500 < T < 560 °C; 4.3 < P < 5.2 kbar) and from actinolite (white amphibole) replacing the green amphibole due to decreasing pressure and temperatureMetamorphic (D2, 415 < T < 480 °C; 1.9 < P < 2.3 kbar). Hydrothermal fluids play a significant role during metamorphism. Chlorite and epidote are formed at the late stage of metamorphism.

Mineralization occurred in two paragenetic stages. Coarse grain of magnetite, chalcopyrite and pyrite formed during the first stage of mineralization and this represent syngenetic mineralization. Magnetite is the main ore mineral and is characterized by large grain with ilmenite exsolution lamellae. The second stage is epigenetic mineralization and is characterized by the formation of secondary minerals, which are replacing the primary minerals. Hematite is replaces primary magnetite. Chalcopyrite, pyrite and magnetite are replaced by goethite, and covellite overgrows chalcopyrite forming a coronatic texture. Fine-grained idomorphic aggregates of magnetite are dominant in the second stage and seem to be formed from iron liberated from pyroxene and other iron-bearing minerals. Structural characteristics of the coarse-grained magnetite refer to the direction of the maximum stretching strain ellipse in the study area, which is in the NW–SE direction.





Proposal for changing the supplementary type locality of the Naokelekan Formation from Gara section (Gara Village)/ Amadiyah Destrict to Duawa section (Duawa Village)/ Raniya Destrict.

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Abstract

The Jurassic rocks are exposed in more than 20 localities in the High Folded, Imbricated Zone and Thrust Zone of northern Iraq (Kurdistan Region). The upper Jurassic (Oxfordian-Kimmeridgian) Naokelekan Formation crops out in most of those localities. The formation is well exposed in few localities where the whole succession is clear and complete. One of those localities where the Naokelekan Formation crops out completely is Duawa section in Duawa village, Betwata area, near Raniya town. This study deals with the possibility of changing the supplementary type locality of Naokelekan Formation from Gara section to Duawa, following the principles of the International commission of Stratigraphy. The Naokelekan Formation was first described by Wetzel and Morton in 1950 from the Imbricated Zone of northeastern Iraq near Rowanduz at Naokelekan village. A supplementary type section was described by Bellen et al. (1959, p. 213). The supplementary section lies in the Chia Gara fold of the High Folded Zone of northern Iraq. It mainly replaces the obscured upper parts of the original type section. The formation was studied completely in Duawa section in terms of Stratigraphy, lithology, microfacies analysis and depositional environment and correlated with Gara section according to previous studies and descriptions in this locality. The Naokelekan Formation in all localities consists of three parts which are composed entirely of thin and thick bedded, bituminous, argillaceous, dolomitic limestone with bituminous, calcareous shales. The formation is underlain by the Sargelu Formation and overlain by the Barsarin Formation. The thickness of the formation at the type locality reaches 14m and in the supplementary type locality reaches 28 m, while in the suggested supplementary type section is about 15 m. Generally, both upper and lower parts of the formation were deposited in euxinic condition of quite sub restricted environment (Subtidal), while the middle part was deposited in a shallow open marine environment.





Analysis of the stress field and determining the safe mud window of drilling mud in the southwest of Iran

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Abstract

The wellbore instability is one of the major problems while drilling. The causes of such a borehole failures often can be prevented by determining the suitable critical mud pressure as well as the optimum well trajectory. Determining the direction and magnitude of principal stresses at deep oil wells is an important point in geosciences and engineering perspective. One of the most important applications of stress regimes information in oil fields is determining the stability of wells. Achieve scientific and engineering approach for finding optimal mud weight, and stable well trajectory, casing set points, sand production, etc. requires accurate study of the stress situation. In this article, the amount and direction of stress in the well is determined from a field in the southwest of Iran. For minimum horizontal stress, in the direction both horizontal stresses, determined by the image log. The position of tensions in the field of study is a normal stress regime. After determining the direction and calculating the magnitude of the stresses in situ, a safe mud window for drilling was designed a stable well.

KeyWords: Reservoir rock, Geomechanics, Tension field, Well stability, Safe mud window





Organic petrography and geochemical characterization of Chia Gara Formation in well Miran-2, Kurdistan Region, NE Iraq

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ABSTRACT

The present study focuses on Chia Gara Formation being part of the oil-prone sedimentary formations of Northern Iraq, which are under extensive scientific concern in recent years. Chia Gara Formation consists of alternating layers of bituminous limestones and calcareous shales deposited during Late Jurassic – Early Cretaceous; it is considered one of the major source rocks of the prolific Kirkuk oil field of Northern Iraq. The objective of the study is the evaluation of the organic petrographical and geochemical features of Chia Gara Formation with the aim to reconstruct the palaeoenvironmental conditions during deposition, the maturity level and the petroleum potentiality. For this purpose, 26 cutting samples from the depth range 2250-2315m of the Well Miran-2 were collected. Determinations of Total Organic Matter (TOM) and Total Organic Carbon (TOC) contents, maceral characteristics, vitrinite reflectance values, as well as Rock-Eval analyses were performed. The mineralogical assemblages of the studied samples were also assessed by means of X-ray diffraction.

The studied sequence comprises mostly argillaceous limestones with calcite and quartz being the main minerals with variable amounts of clay minerals, K-feldspars, pyrite, gypsum and anhydrite. TOC wt.% ranges between 0.73-7.24 wt.%, while the respective range of TOM is 4.8-15.9 wt.%. The average Vitrinite reflectance (VRo) is 1.01% and the original average value of solid bitumen reflectance (BRo) 0.72%.. Solid bitumens are predominant with almost absence of liptinite (kerogen types I & II), considering that the bitumens consist the solid, residual phase of hydrocarbons in the source rock. Additionally, the often occurrence of vitrinite fragments indicates a significant terrestrial input (kerogen type III). However, huminite particles were also observed, most probably originating from the drilling mud, and hence the organic geochemical features seem to be affected by this contamination.





Therefore, organic petrography proved to be the most important tool to provide with clearcut results regarding the organic matter characteristics. Chia Gara Formation in Miran-2 well is within the oil window, and the results are particularly promising regarding the potential productivity of the Formation.

Keywords: Chia Gara, Maceral, Maturation, Solid bitumen, Kurdistan





Platinum group elements (PGE) and Au geochemistry of peridotite rocks in Mawat and Penjween ophiolite complexes, NE Iraq.

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Abstract

The Mawat and Penjween ophiolite complexes represent an integral part of the Peri-Arab ophiolite crescent. These complexes are parts of thrusting Iraqi Zagros Suture Zone (IZSZ) in Northeastern Iraq. Two points of view have appeared to explain the nature of these ophiolitic complexes. The first suggests that the complexes were formed independently. The second suggest that the complexes were formed as one part and then separated into two parts. In general, the Penjween Ophiolite Complex (POC) is larger and more extensive than the Mawat Ophiolite Complex (MOC). The results of petrographical study of more than 30 rock thin section and ICP-MS analysis of 16 bulk-rock samples of MOC and POC peridotites, indicated that the PGE content of chromitite bearing peridotite rocks is relatively low ($\Sigma PGE=77-103$ ppb and 66-131ppb in MOC and POC, respectively) and very similar in the two regions. This level of PGE support that these rocks may strongly belong to the transition zone of the mantle. It is believed from the high IPGE/PPGE in the two complexes rocks, that the PGE-rich magma lost its IPGE by forming IPGE-rich chromitite at the depth parts of the mantle

Keywords: Platinum group elements, geochemistry, peridotite, ophiolite, Mawat, Penjween





Genesis and mineralogy of sulfide mineralization in Korradawi, Kurdistan region

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Abstract

The study region is located in the Kuradawe village, 65 km NE of Sulaimani city, in the east of the Kurdistan Region. Sulfide mineralization in Kuradawe hosted by gabbro of the Mawat Ophiolite. Gabbro has various microdomains, which contain different amphiboles and plagioclase. This indicates that the original magmatic rock and the minerals were influenced by metamorphic overprint. The mineral assemblage of gabbro is representing by white amphibole, green amphibole, plagioclase, chlorite, quartz, epidote, pyrite, and hematite. The metamorphic history can be subdivided into the stages M1-M2. The first stage of metamorphism was recorded by formation of green amphibole (hornblende) replacing clinopyroxene. A decrease of temperature and pressure resulted in the formation of white amphibole (actinolit) coronae growing on previous amphibole or clinopyroxene. The late stage of metamorphism is recorded by formation of chlorite and epidote. Parageneses sequence show two stages of mineralization. Sulfide mineralization represent the first stage of mineralization and it is the main ore mineral. Hematite is formed in the second stage and it is represent the secondary mineral replacing pyrite. $\delta 34S$ values of the pyrite range from + 7 to + 9 ‰ and indicate that the sulfur was derived from magmatic hydrothermal.





The Effects of Daryan Dam on the Future of Sirwan River in Kelar/Garmian Area/Kurdistan Region of Iraq

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Abstract

Dams are constructed to provide water for irrigation, domestic and industrial usages, to help control floods and for hydropower generation. Therefore, dams are essential for the country's socioeconomic improvement. Regardless of the benefits provided by the construction of a dam to humanity, abundant environmental negative impact have occurred as a result of these projects counting flow flux of downstream altered, flooded area reduced, chemicals and other organisms modified. However, no research has been done on the hydrological and environmental negative impact of Daryan Dam on Sirwan River in Kelar district. The objective of the study was to determine the effects of Daryan as a new constructed dam on the Sirwan River close to its border with Iraq, on the negative impact of shortage water in the Sirwan River in Kelar/Garmian, which was the study area, and the critical sector of habitant's life with come across of a water crisis in coming few years. The study also concentrated in altering the river's water physicochemical properties. Sirwan River is only river in our region that runs through Iran and Iraq. Results of the study indicate that, the total water are required is 45 cubic meters of water in a second, and fortunately, presently more than this value can be achieved in Kelar. Physicochemical properties of Sirwan River in the investigated area are in accordance with Iraqi standard limits for water.

Keywords: Daryan dam, hydrological, environmental impact, Sirwan River/Kelar.





Magnetic Technique for Prospecting Al-Wasiti Archaeological Site, Southern Kirkuk city, Iraq

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Abstract

The geophysical methods applied in archaeological field are acquiring a growing weight during the last years in the archeological projects. A geophysical magnetic technique was applied aiming to locate buried artifacts at Al-Wasiti Archaeological Site, Southern Kirkuk city, Northeastern Iraq. A total of 11 profiles were acquired by a portable (MCL-2 microcomputer magnetometer), which can measure the vertical component of the magnetic field. At the beginning a reconnaissance magnetic survey has done in order to choose the convenient measuring altitude of the sensor and the suitable station - spacing. Measurement were taken from 50 cm height above ground surface, with 10 m. station - spacing. The distance between parallel profiles was five meters.

The observed magnetic reading were corrected for the daily changing of earth magnetic field, while the normal correction was neglected because the space of the area is small and terrain correction was not applied because the area is nearly flat and sedimentary . Then a vertical field magnetic map was drawn from the corrected data. Many samples of archaeological bricks and soil were collected from the study to measure their magnetic susceptibility using the instrument (SM-30). The corrected data were exported into a grid file to the program Surfer11 to create contour maps. The magnetic data treated by applying different methods such as the graphical and the polynomial analyses for regional - residual separation. The qualitative and quantitative interpretation has done on the magnetic field map by using different limited ways and the central anomalies have been identified on the remaining and vertical magnetic field map. The quantitative interpretation has done using the fore ward modeling of chosen traverses by the program (Mag2dc). The magnetic survey evidenced the presence of many anomalies, due to buried features. The qualitative and quantitative analyses showed that the negative anomaly is a result of the existence of canals, trenches or graves (cellars). Positive, linear-elongated anomaly reflects the existence of extended archaeological walls that have been built from mud or backed clay. Positive, circular or quasi-circular anomaly represents a base foundation for construction, which may have been destroyed or disintegrated by influence of weathering or other factors

Keywords: magnetic technique, Archaeological Site, resistivity technique.





Distribution of Secondary Minerals and Trace Elements in Guano Deposits of Karaftu Cave, Kurdistan, Iran

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Abstract

The Karaftu Cave is located in the 67 km of northwest of Divandareh city, Kurdistan province. This cave is formed in limestone of Oligo-Miocene Qum Formation. The cave floor, in some places on the second floor, is covered by guano deposits, bat droppings and animals' cave dwellers. Fresh guano decays through bacterial and fungal respiration can release organic and inorganic acids. Interactions between these acidic solutions with guano depositswere caused to leaching, dissolution, and changing abundance of trace elements. During this process some secondary minerals such as taranakite, francoanellite, spheniscidite, whiteolockite, pyrocoproite, brushite, leucophosphite, urea, niter, cesanite and gypsum were produced in the guano. The existence of these various minerals and fluctuations in abundance of trace elements in terrigenous particles of Karaftu Cave guano deposits indicate three different paleoclimate conditions (inclusive dry, humid, and dry terms, during accumulation of bat guano), a continental island arc provenance and the upper continental crust source rock.

Keywords: Karaftu Cave, Guano, Trace elements, Taranakite, Whitelockite





Source rock evaluation and lateral changes in thermal maturity of the Sargelu Formation (Middle Jurassic) in Kurdistan Region- Northen Iraq

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Abstract

In this study, source rock characteristics and lateral changes in thermal maturity of the Sargelu Formation (Middle Jurassic) in three outcrops were studied. The formation's outcrops can be found in the High Folded, and Imbricated Zones of Iraqi Tectonic Division. In order to achieve the main goals of this study, the Gas chromatography mass spectrometry (GC-MS) and Rock-Eval pyrolysis were performed on the organic matter (OM) of the Sargelu sediments. Pristane/Phytane ratios are less than one (1.0) for analyzed samples in which indicate reducing conditions (anoxic) during sedimentation. Almost all samples show C29/C30 hopanes ratios less than one (1). These ratios indicate that the sediments of the Sargelu Formation associated with clay- rich source rock. Thermal maturity parameters such as C32 hopanes 22S/ (22S+22R), steranes C29 20S (20S+20R), steranes C29 $\beta\beta/(\beta\beta + \alpha\alpha)$ display that all samples are thermally in Oil Window at least. The biomarker findings reveal that the samples of Walasimt and Barsarin are seem more mature than Banik section. The average values for TOC% of the Sargelu Formation were 6.7, 1.7 and 0.09 for Banik, Barsarin, and Walasimt sections respectively. These values may show Excellent, Very Good, and Poor quality source rock. The Pyrolysis executed for studied samples revealed the kerogen in Banik section belongs to Types II and III (Probably Oil/Gas- prone), while Barsarin and Walasimt sections obtained Types III-IV Kerogen (Gas- prone). Pyrolysis parameters suggested Early Mature Stage in Banik, While Overmature in Barsarin and Walasimt. The data also shows that organic matter of the Sargelu Formation in Banik section is in Oil Widow, while in Barsarin and Walasimt is in Gas Window. Both TOC wt.% and thermal maturity of organic matter decrease from east (Walasimt) to west (Banik section) of the study area.

Keywords: Sargelu Formation, Biomarkers, Rock-Eval, thermal maturity, Kurdistan, source rock





Well Log Analysis to Assess the Petrophysical Parameters of the Lower Cretaceous Qamchuqa Formation, Erbil area, Kurdistan Region.

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Abstract

The lower Cretaceous Qamchuqa Formation has been studied and evaluated in view of petrophysical properties and reservoir characterization in the studied well, Erbil area, Kurdistan Region. The depth interval of the Qamchuqa Formation in this well is between (1790-2040) m. Well log is the main method that has been used and applied in this study. The available log data have been used in evaluating and characterizing the properties of reservoir of the studied formation. The porosity logs and photoelectric log have been used to estimate the dominant lithologies by utilizing of some crossplots such as (M-N, N-D Combination and Photoelectric Factor (PEFZ) cross-plots). The dominant detected lithologies are mostly limestone, dolomitic limestone and dolomite in addition to few of thin beds of anhydrite, sandstone and shale. Shale content has been calculated from the gamma ray log which shows almost of dispersed shale type distribution with a few of clean formation which shown in neutron-density porosity cross-plot of Thomas-Stieber. The porosity has been calculated by sonic, neutron, density and their combinations which were shown in quick plots. Also the measured porosities have been corrected by subtracting the effect of shale content. The Qamchuqa Formation has been subdivided into four reservoir units depending on the porosity, permeability and shale content.

By using the resistivity logs, the water saturation has been calculated and it has indicated the presence of hydrocarbon saturation with different values in the reservoir units and the probability of hydrocarbon production with different ratios of water that has been measured by calculating the bulk volume of water and the existence water appeared not to be irreducible saturation condition.

Keywords: Well logs. Petrophysics. Qamchuqa. Reservoir.





Microfacies analysis and Depositional Environment of Khurmala Formation (Paleocene-Lower Eocene), in the Zenta Village, Akre District , Iraqi Kurdistan Region

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Abstract

Microfacies and environmental analysis of Khurmala Formation (Paleocene-Lower Eocene) was studied in the Zenta area, near Zenta village, Akre district –Kurdistan region Northren Iraq. Lithologically, the formation composed of 71 m thick bedded grey dolomitic limestone which partially bearing bitumen with nodules and rare lenses of cherts and medium to thick bedded yellow limestone interbeded with thin beds of marl and mudstones. Petrographic study of carbonates on 32 thin sections showed the majority of limestones are carbonate mud (micrite). The skeletal grains consist principally of benthonic foraminifera, calcareous green algae, ostraocds, gastropods, pelycepods, and rare larvae echinoids. Non skeletal grains include peloids only. Depending on field observations and petrographic analysis, two different lithologic units were recognized in the Khurmala Formation at studied section. They are in ascending order: thick bedded dolomitic limestone unit and bedded limestone with marl unit. Based on detailed microfacies analysis of limestones, three main microfacies were distinguished in the studied section of the Formation. From the sum of all petrographic, facies, textural analyses concluded that Khurmala Formation was deposited at a shallow marine environment (shelf lagoon with circulation), quiet, and semi restricted conditions.

Keywords: Khurmala, Paleocene, Zenta, Microfacies analysis, lagoon.





Permeability Modelling in Carbonate Reservoir rocks using Nuclear Magnetic Resonance Measurements

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Abstract

The permeability prediction of carbonate reservoirs is considered a difficult to accurately determine for reservoir evaluation in the petroleum industry. The permeability models do not provide good or precise permeability prediction result in carbonate rock. This is because of the pore system and rock matrix heterogeneity in the carbonate reservoir rock. This study deals with permeability modelling in tight carbonate oil reservoir rocks using nuclear magnetic resonance technique for selected samples collected from the Kometan Formation in Kirkuk embayment oil fields. This work presents the results of laboratory measurements of 125 non-fractured core samples, which have helium porosity in the range 0.05 ± 0.05 to 0.30 ± 0.05 , and Klinkenberg-corrected permeabilities in the range $0.65\pm0.08 \mu D$ to $700\pm0.08 \mu D$.

The predicted achievement of Free Fluid Model of permeability was analysed with the measured permeability of the data set. In an attempt to provide an acceptable model for carbonate rocks, we have used measured fluid movability index derived from reservoir parameters including T2 cut-off of the selected oil fields instead of standard parameters. Three groups of samples have been classified to use different magnitudes of C in the free fluid equation based on pore structure in the measured samples. The micro- intercrystalline pores required C=50, followed by C =40 value for the meso-intragranular and moldic pores while the highest magnitude of C = 60 are expressed for the nano-intercrystalline pores. The measured data performed very creditably with the modified Free Fluid Model for carbonate rocks. It is clear from this study that the blind application of conventional permeability prediction techniques in carbonates and particularly to tight rocks can lead to gross errors. 2

Keywords: Permeability prediction, NMR, pore system, carbonate reservoir, Kirkuk embayment fields





Sedimentology of Shiranish Formation in Mergasur Area, Iraqi Kurdistan

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Abstract

The Upper Cretaceous Shiranish Formation of Shkawtua Village, Mergasur Area, Iraqi Kurdistan Region consists of mixed siliciclastic and carbonate strata alternately interpreted as outer shelf open marine (basinal) environment deposits. Fourteen thin sections were studied under Polarized Microscope to determine the petrographic component, fauna content, and microfacies analysis. Rock units divided into: marly limestone; marlstone; and dolostone. The major petrographic constituents are: micrite; pseudospar; replacement dolomite; and fossils. Fossils are the main skeletal grains within mudstone, wackestone, and packstone microfacies type.

Keywords: Cretaceous, Shiranish, Carbonate sedimentology, Mergasur, Iraqi Kurdistan





The impact of tectonic setting on distribution of Kolosh formation during Paleocene –lower Eocene in northern Iraq

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Abstract

This study covered most of Kolosh formation exposure areas in northern Iraq. Description of the lithology and measure the actual thickness of the formation from exposures and well logs were performed. The isopach map of the formation was constructed. The distribution of the formation sediments was affected by the tectonic activity of the northern edge of the Arabian plate during the closure of the new Tithes. The tectonic setting outlined the depozone of foreland basin system and controlled the variation of the deposits of the Kolosh formation along the orogeny front (more than one basin of deposition). The deviations of the centers of the Kolosh deposit basins from the current folds are calculated. The counterclockwise rotation of Arabian plate and its oblique collision with the Iranian plate as well as the rejuvenation of the basement faults during the peak of the orogeny might cause such this deviation.





Groundwater Management using Hydro-Geophysical Investigation of selected field-Zarayan area, NE of Iraq

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Abstract

Groundwater resources management in Kurdistan region, Iraq require different techniques and scientific principles. This study aims to assess and better manage groundwater resources via hydrogeophysical investigation. Two traverses are selected for a geoelectrical and hydrogeological survey for determining the characteristics of the aquifers in the study area. The SYSCAL Jr switch-72 and later the two-dimensional 2D model interpretation was performed using the latest version of the RES2DINV software package. The results and interpretations of the two traverses show that the resistivity of the aquifer ranges between 10-80 ohm.m, and there are two different aquifer layers at different depth with lenses in the study area. The shallow one is between 10-20 m, and the deeper one starts after 40 m depth. Furthermore, it revealed that the aquifer is consists of the combination of gravel, sandstone, and clay. The geophysical results and the collected drilled well data are too close, and it revealed that the aquifer has a big reserve of water.

From the current study, it proved that the geoelectrical survey considered as an important technique for evaluating and management of groundwater resources.

Keywords: Geoelectrical survey, Kurdistan, groundwater management, hydrogeology





Planktonic Foraminiferal Biostratigraphy of Cretaceous/Tertiary Boundary in the Smaquli area, Sulaimani region, Kurdistan, NE-Iraq

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Abstract

The Cretaceous / Tertiary (K/T) boundary section, which crop out in the studied section are located within the High Folded zone (Smaquli area), in Northeastern Iraq. These units mainly consist of flysch and flysch type successions of thick beds of clastic rocks of Tanjero / Kolosh Formations. The study is specially focused on analysis of all the uncertain aspects of the boundary zones, such as lithostratigraphy, biostratigraphy, nature of contact, age determination, local and regional correlation in order to answer many of the questions raised naturally through different researches and studies since decades by different authors in and outside Iraqi regions The detail lithostratigraphic study achieved on the cropped upper part of the Upper Cretaceous successions in the Gali section (Smaquli area) the studied stratigraphic units include the upper part of Shiranish Formation, Shiranish-Tanjero transition unit, Tanjero Formation and Kolosh Formation of the Early Tertiary. Based on identified planktonic foraminiferal assemblages Eight biozones were recorded within uppermost part of Shiranish Formation, Shiranish-Tanjero transition unit (Reddish to pale brown succession), Tanjero Formation, these zones are from the bottom to top: upper part of Globotruncana aegyptiaca Interval Zone (CF8), (Upper part of Shiranish Formation and Lower most part of Reddish to pale brown succession) (Early Maastrichtian), Gansserina gansseri Interval Zone (CF7), (Reddish to pale brown succession) (Early Maastrichtian), Contusotruncana contusa Interval Zone (CF6), (Reddish to pale brown succession), (Early Maastrichtian), Pseudotextularia intermedia Interval Zone (CF5) (Reddish to pale brown succession), (Early Maastrichtian), Racemiguembelina fructicosa Interval Zone (CF4), (upper most part of Reddish to pale brown succession and lower part of Tanjero Formation) (Late Maastrichtian), Pseudoguembelina hariaensis Interval Zone (CF3), (Tanjero Formation) (Late Maastrichtian), Pseudoguembelina palpebra Interval Zone (CF2), (Tanjero Formation) (Late Maastrichtian) Plummerita hantkeninoides total range Zone (CF1), (Tanjero Formation) (Late Maastrichtian) and also four biozones are recorded within the Kolosh Formation: Guembelitria





cretacea Interval Zone (p0), (Kolosh Formation), Earliest Paleocene (Danian), Parvularugoglobigerina eugubina total range Zone (pα), (Kolosh Formation) Earliest Paleocene (Danian), Parvularugoglobigerina eugubina - Subbotina triloculinoides Interval Zone (P1a), (Kolosh Formation), Early Paleocene (Early Danian), Subbotina triloculinoides – Praemurica inconstans Interval Zone (P1b) (Kolosh Formation), Early Paleocene (Danian).

Keywords: Biostratigraphy, Cretaceous/Tertiary boundary, Sulaimani, Kurdistan Region, Iraq





Identification of HC Micro Seepage Using Multi Spectral Image Processing in Takya Area, Kurdistan Region – Iraq

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ABSTRACT

The display of the significance of the remotely sensed data in geological exploration, multispectral satellite image processing techniques were used to identify anomalous areas or alteration zones caused by hydrocarbon micro seepages in Takya area, Kurdistan Region. Three image processing methods were used including band rationing (BR), principal component analysis (PCA), and falsecolor composition (FCC), then tonal anomalies and subtle changes in spectral content are consider as surface indicators for micro seepages.A combination of ratio images based on the spectral characteristics of hydrocarbon-induced minerals was selected. This combination consists of (5/7, 5/4, 3/1). Based on the analysis of eigenvectors and eigen-values derived from different combinations of principal components analysis, five principal components including 13457 were used and PC3 showed steady spectral enhancement for the hydrocarbon-induced minerals. Image enhancement includes A false color image of the sub scene was produced by assigning band (741) and the extracted colored composite image was found to be useful in emphasizing to the all materials of altered rocks in the study area. The result proved the existence of hydrocarbon seepage and indicates that the major factor controlling the seepages is the deformation by the tectonic processes as well as the integrated and concluded data from previous methods and analysis have been used to understand the tectonic relationship between the hydrocarbon seepage and the structural elements of the area under investigation.

Keywords: Hydrocarbon seepage, ratio image, principal components analysis





Earthquake Moment Tensor Analysis Using Broadband Seismic Waveforms

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Abstract

In this study the focal mechanisms are determined for the broadband waveforms of the earthquakes occurred in Kurdistan region, NE-Iraq and west of Zagros Mountains which are recorded by Sulaimani and Duhok University Observatories (SUO) and (DHK) respectively and Kandilli Observatory and Earthquake Research Institute (KOERI) using moment tensor analysis. The seismic moment, depth and the nature of responsible fault that ruptured at the source are calculated by the waveform inversion. The inversion technique used is a grid search over the strike, dip and rake angles for each depth from 0.5 to 39 km in increments of 1 km. The observed and predicted waveforms are filtered and compared using bandpass filters and a proper velocity model for the Green's function. The mechanism to the best fit was determined and the regional stresses was characterized in the study area. The results indicate a combination of mostly strike-slip with some dip-slip and oblique-slip motion.

Keywords: focal mechanism, moment tensor inversion, earthquakes, Seismic waves.





Geo-Environmental Evaluation for Shewasoor Soil, Kirkuk/ NE Iraq

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Abstract

The present study aimed to evaluate contamination levels in soil by heavy metals. Eight sites were selected for the collection of soil samples. The soil samples analyzed for eight heavy metals namely As, Pb, Cd, Cr, Co, Cu, Ni, and Zn by using ICP-MS technology. The measured concentrations of heavy metals were compared with Geochemical Background values, EPA Sediment Quality Guidelines, EPA Ecological Screening values, and WHO Guidelines. The spatial distribution patterns of environmental assessment indices were determined using Geographic Information Systems (GIS), which is gives understanding for the geographical distribution of contamination levels in the area. The heavy metals contamination assessed by using several environmental factors and indices: Contamination Factor, Degree of Contamination, Pollution load Index, Enrichment Factor, Geoaccumulation Index, Nemerow Index, Potential Ecological Risk Index, Nemerow Pollution Index, and Non-carcinogenic and Carcinogenic Health Risk Assessment. The environmental factors and indices showed that the soil was moderate to heavily contaminated by studied heavy metals. The EF values indicated that the metals Pb, Cr, Co, Cu, and Zn were enriched from natural sources, while the metals Cd, Ni, and As were enriched from anthropogenic sources. The hazard index (HI) and cancer risk were used for non-carcinogenic and carcinogenic risks assessment, the results of HI indicated acceptable risk for adults and unacceptable risk for children. While the total cancer risk values of As and Cr was in acceptable limits, whereas Pb, Cd, Co, and Ni was lower than acceptable risk range at all sites for adults and children.

Keywords: Geo-Environment, Heavy Metals, Contamination, Pollution, Human Health Risk, Soil, Shewasoor.





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.





Depositional Sedimentary environment Avanah Formation from selected sections with in Zagros high and low folded zone, Iraq

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ABSTRACT

The Avanah Formation of the Middle-Upper Eocene carbonate sequence, has been studied within the boundary between Zagros High Folded Zone (ZHFZ), and Zagros Low Folded Zone (ZLFZ) from two well exposed outcrops (Sartek Bamo and Bellula locations) and two other subsurface wells from the Avanah dome (Kirkuk Oil fields) at Zagros Low Folded Zone (ZLFZ). Lithostratigraphic, lateral and vertical facial changes, petrographic constitutes, diagenesis, and microfacies analysis are the main aims of this study for determining and reconstructing the depositional environments of the Avanah Formation from the selected sections. Different diversities of some species and genera of larger benthic foraminifera have been defined within the studied limestone rock units. Nummulites, Alviolina, Discocyclina, Orbitolite, Miliolids, and some calcareous algae; mollascas; echinoderms and their bioclasts are the main fossils constituents that detected in this study. Cementation, dissolution, compaction, micritization, , and fracturing are important diagenetic processes in the Avanah Formation, occurring in marine to meteoric and burial diagenetic environments.

Petrographic studies have led to the recognition of 11 micro and sub-microfacies types. The depositional environments of the Avanah Formation in the studied sections were ranging from inner to mid-ramp depositional environments.





Applications of Quick Look Methods for Evaluating the Middle Miocene Jeribe Formation from a Selected Well in Jambour Oilfield, Kurdistan Region-Northern Iraq

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Abstract

Quick Look Methods (QLM) in log interpretation are helpful to the geologist because they provide flags, or indicators, that point to possible hydrocarbon zones requiring further investigation. The importance of QLM is in their ability to provide information about the nature of the fluids in the pore spaces and the lithology of the reservoirs in a quick and simple way. Three ways of QLM applied on the Middle Miocene Jeribe Formation from the well of Ja-49 in Jambour Oilfield. The apparent water resistivity (Rwa) method helped in quickly detecting the hydrocarbon bearing zones of the formation. The Logarithmic Movable Oil Plot method assisted in detecting the intensity in the movability of the hydrocarbons within the hydrocarbon bearing zones of the formation. Movable Hydrocarbon Index (MHI) also used as QLM for detecting the movability of the hydrocarbons through calculating the ratio of water saturation in the uninvaded zone to that of the flushed zone. Accordingly, the formation in the studied well appeared to be generally a hydrocarbon bearing reservoir with zones of different movable hydrocarbon potentiality.

Keywords: Jeribe, Jambour, Log analysis, QLM, Kurdistan Region





Application of Flow Zone Indicator Method to Determine the Hydraulic Flow Units in the Middle Miocene Jeribe Formation From Selected Wells in Hamrin Oil Field/ Northern Iraq

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Abstract

The Middle Miocene Jeribe Formation has been studied from reservoir potentiality point of view from the three wells of Hr-49, Hr-50, and Hr-51 in Hamrin Oil Field/Northern Iraq. The calculated porosity from the Sonic, Density, and Neutron logs corrected from shale effect and showed variations from less than 5% in the rich shale zones to more than 20% in the less shale content at upper and most lower parts of the formation. Permeability calculated for Jeribe Formation in this study depending on multilinear regression method using the available core analysis data (porosity and permeability) and log data from the nearby Hr-2 well. Four Flow Zone Indicators (FZI) representing four unique Hydraulic Flow Units (HFU) identified in the studied Jeribe Formation and that from both the relationship between the calculated Reservoir Quality Index (RQI) and the Normalized Porosity Index (Øz), and also graphically through the variations in the slope of the cumulative distribution of the FZI. Comparison between the calculated values of FZI and Movable Hydrocarbon Index (MHI) revealed to identify horizons with different productive capacity along the studied sections.

Keywords: Hamrin, Jeribe, Flow zone, Movable hydrocarbons





DEM-GIS Based Geometric Analyses of Kufri Dam, Kurdistan, Iraq

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Abstract:

The geometric analyses for each reservoir area represent an important database to aid dam's designers. New Innovated methodology used the Digital Elevation Model of Kufri dam reservoir area to extract the geometric characteristics of the reservoir depending to the analyses of volume-arealevel relations of the reservoir depression. The area that surrounded within the borders of maximum contour line for the reservoir which represent 279 m a.s.l. according to the design of dam, was extracted and exported as a global mapper package file. Then this data file used to extract the elevation data for the hypothetical levels from 258 m a.s.l which represent the minimum operation level, to maximum 279 m a.s.l. with 0.15 m interval, these data was exported as SURFER grid files to derive the geometric elements. Ten geometric elements were suggested and derived in this proposed methodology, which are the positive volume (for islands), negative volume (for reservoir), positive planar area, negative planar area, positive surface area, negative surface area, residual capacity, average island thickness, and average depth for each corresponding level, in addition to dead storage. The relationships of the geometric parameters of storage volume, submerged area, surface area, and positive elements were constructed against hypothetical levels and then statistically processed. The optimum operation and flood levels for the reservoir were selected dependence on the geometric parameters. Also, the dead storage map and the depth maps for selected water levels were derived, plotted and analyzed.

Keywords: dam; reservoir; DEM; GIS; geometric analysis; dead storage; depth map





Geological Field Trip Guide

Thursday 07/12/ 2017

Field trip to Dukan area

In the Zagros High Folded Zone



Hosts Dr.Ghfor A. Hamasur Dr. Salim H. Sulaiman Department of Geology, University of Sulaimani Mr. Salam N. Mohammed Dukan Dam





Trip Program:

Day 3 Thursday 7th December 2017

08:30-16:30 Field trip to Zewe Gorge in Piramagroon Anticline, Jasana Cave within Surdash Anticline, Dukan Dam on the lesser Zab River and then to the Restaurant in Dukan City

Hosts: Dr.Ghfor A. Hamasur and Dr. Salim H. Sulaiman

Department of Geology, University of Sulaimani

Mr. Salam N. Mohammed (Geologist, Dukan Dam)

08:30	Departure from the Hotel by bus	
09:30-10:30	Stop No.1.	Zewe Gorge in Piramagroon Anticline
11:00-11:45	Stop No.2.	Jasana Cave within Surdash Anticline
12:15-13:30	Stop No.3.	Dukan Dam on the Lesser Zab River
13:30-15:30	Stop No.4.	Restaurant in Dukan town
15:30		Departure to the Hotel by bus

Preface

Sulaimani city located at the High Folded Zone close to the margin of the imbricate zone of the Zagros Fold Thrust Belt (ZFTB). ZFTB as a part from Alpine orogenic belt distributed between Iraq and Iran and extends for about 2000 km resulted from the collision between Arabian plate and Eurasian plate in Eocene before 45 Ma. The trend of the folds and the strike of the strata are generally in NW-SE direction in accordance with the main trend of Zagros folds. Generally, the amplitude and intensity of the folds increase towards the Zagros Thrust Zone. Nearly all of the anticlines within the area have vergence toward southwest. Vertical and overturned beds are common along the southwestern limbs of these anticlines. There are obvious changes in the strike direction of the structures and even swinging of the strike within each single structure.

The oldest rocks in the study area are cropping out within the core of Surdash and Piramagroon anticlines and belonging to the Jurassic age. Figure one shows the main structures around Sulaimani and the boundary between high folded and imbricated zones. Figure two shows field trip road and locations of the examined stops from Sulaimani City to Dukan. Figures three and four show tectonic Subdivisions and Stratigraphic column of Sulaimani Area respectively







Fig.1: Shows the main structures around Sulaimani and the boundary between high folded and imbricated zones

The trip includes three stops along the road from Sulaimani to Dukan as follow:



Fig.2: Field trip road and locations of the examined stops from Sulaimani City to Dukan.









Fig.4: Stratigraphic Column of Sulaimani Area.





Stop (1)

(Zewe Gorge in Piramagroon anticline)

Downward of Piramagroon anticline is the first appearance of turbidite lithofacies which represent Tanjero Formation, and blue marl of Shiranish Formation. Transition area is between gentle slope and high cliff, steep slope is in the appearance of fresh white weathering, light grey well bedded limestone represent Kometan Formation. All high cliffs are black bituminous continuous succession of massive limestone and dolomite of the Qamchuqa Formation. In the end of high cliff the slope direction toward the center of the core soft marl and marly limestone beds that easily weathered represents Sarmord Formation is appear. Lithofacies of Balambo, Chiagara, Naokelekan, Barsarin, and Sargelu formations appear in the core of Piramagroon anticline. Figure 5 shows succession formations that appear in the core of Piramagroon Anticline. Figure 6 shows geological map for Zewe Gorge in Piramagroon Anticline (Qaradaghi, 1998). Figures seven and eight show two cross sections of Zewe gorge.



Fig.5: Succession formations that appear in the core of Piramagroon Anticline. The photo tacked from northwestern of Zewe village.





Fig.6: Geological map for Zewe Gorge in Piramagroon Anticline after (Qaradaghi, 1998)



Fig.7: Geological cross section on the Piramagroon anticline through Zewe Gorge after (Qaradaghi, 1998)



Fig.8: Geological cross section on the Piramagroon anticline through Zewe Gorge (after Al-Hakari, 2011)




Stop (2)

(Jasana Cave in Surdash Anticline)

This cave is about 50 Kms west of Sulaimani city within Surdash Anticline on the Sulaimani – Dukan road. It is located behind Kani Khan Village on the foot of a big mountain.

On 3/2/1923 the British army bombarded Sulaimani city by aircraft during their conflict with King Mahmood who was forced to leave Sulaimani and move to Surdash area making "Jasana Cave" his Headquarters and safe haven, this cave also witnessed the issuance of the first edition of "Bangi Haq" newspaper meaning (Call for Truth, or Call for Justice) through the press that was brought over to the site. Figur nine shows Jasana Cave in Surdash Anticline



Fig.9: Shows Jasana Cave in Surdash Anticline





Stop (3)

(Dukan Dam)

Dukan Dam



The Dukan Dam is located approximately 300 km north of Baghdad and 65 km northwest of Sulaimani on the Lesser Zab river .The dam is a concrete arch formed with gravity abutment blocks, ,and it is located in a narrow, steep sided limestone gorge approximately 511m above sea level. The dam is 360rn long and is 516.5 at it is highest point. The reservoir controlled by the Dukan dam has a total capacity, of 6.870 billion m³, of which 6.140 billion m3 is live storage and 0.730 billion m³ is dead storage. The dam was designed by the British firmBinnie, Deacon& Gourley for the Government of Iraq. Construction began in 1954 and took five years to complete in 1959. Dumez-Ballot from France was the primary civil contractor and the gates and other associated E&M equipment was supplied by Nerpic from Grenoble, France. Construction of the powerhouse at the toe of the dam did not commence until 1975 and the last of tire 80-turbineunits was completed in 1979.

Gated spillway

Located on the Left side of the dam, the spillway is used to release water for irrigation during the summer and autumn or in case of an emergency such as flood. The intake is at elevation 496.5 meter above sea level, and it is equipped with three(10x6.8 m)vertical gates ,All of the gates are connected to an 11 m diameter tunnel that extended over 305m downstream end to discharge water into the lesser Zab river. Each gate can discharge (700-800 cm/s) and can be operated both electrically and manually

The third international geological conference of Kurdistan







Bellmouth spillway

The Bell mouth spillway is a Morning Glory spillway, with a 40.26 m diameter opening at an elevation of 511m above sea level, the spillway Connected to a series of tunnels: first, a vertical tunnel over 12.5 m diameter, second to a horizontal tunnel of 10.2 m diameter and: finally, to steel-lined tunnel just under 9.9 m in diameter that project upward at a 30 degree angle. The spillway discharge up to 1860cms.







Irrigation tunnels

There are two steel-lined irrigation tunnels in the dam that are each 2.28 m in diameter and 160m long. They are Located on the right side of the dam at the lowest point, which is an Elevation 414.90 m above sea level. The tunnels are controlled from the crest of the dam by Emergency Gates with a Butterfly guard valve and Hollow jet discharge valve, each one can release a discharge of 110 cm/s when the reservoir level is 511 meter above sea level.



Hydropower station

The power station was added to the dam in 1978-79 by techno prom Export from the former USSR. It consists of five steel-lined power outlets that each has diameter of 3.65m. They are controlled on the upstream end with the Intake gates and from downstream by control valves. Their total capacity is 400 megawatts.









Looking forward to seeing you in Sulaimani at

GEOKURDISTAN IV

The third international geological conference of Kurdistan





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