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Effects of Soil DepthAnd Rivers Slopon Total BoronContentIn Some of The Iraqi Provinces

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Abstract

Aiming to study effects of soil depth and rivers slop on total boron concentration inMiddle Euphrates River Reion that represent in the sedimentary plain, soil pedon samples of cultivated territory that adjacent to rivers were taken. Theseregions are located in provinces of Karbala, Babylon, Najaf, Diwaniyah, and Al-Muthana. Ten soil pedon were taken of soils that adjacent to the main Euphrates River, the Al-Hilaa, and the AL-Daghara Rivers in these provinces. Soil pedon of soils that on the banks or close to the main Euphrates River were taken of counties of Twarije, Kufa, Gamas, and Al-Samawa. In the same way, soil pedon of Missaib, Hashmiah, Diwaniyah, and Rumitha are adjacent to the Hilla River and soil pedon of Al-Daghara and Affak belongs to the area of Al-Daghara River. Results show a reduction in total boron concentration for all of the tested soil pedon directly related with the depth. Aggregate boron concentration values are the highest at the surface layer and reduce as going depth except for soils of Al-Samawa and Al-Rumitha. Total boron concentration values are fluctuated between 1.033 mg. kg^{-1} and 14.658 mg. kg^{-1} in all of the studied soils. the results showed too the total boron values are not conducted with the tourmaline mineral percent in all sites.

Introduction

The most common boron form of its natural geological resources is boric acid, H_3BO_3. In nature, it is bound to other material forming compounds named borates and borates ions $B_2BO_3^{-3}$. In cultivated soils, boric acid is the most common, [1].Salinity affected soils that have poor drain system is known for its high boron concentration. Source of boron in these soils is either of irrigation water or of underground water that actively contribute in increases soil salinity, which mostly enrich with different ions form of boron. Moreover, aggregate boron content in soil is depends also on the original materials, [2] ,[3]. Boron is existed in the dry and semi-dry soilsand it is easy washable, [4] . Acidic soils, soils that boron have been washed of, carbonates minerals enrich soils, and sandy soils that lacked to organic matter are considered as boron poor soils, [5]. Its concentration increases on the surface layer in dry and semi-dry soils, [6].

*** part of Msc thesis for the scorned author**

Sedimentary rocks contain range of boron of (20- 100) mg.kg^{-1}. Its content in soils that derived of these rocks is fluctuated between (7-80) mg. kg^{-1}. They have boron more than igneous rocksits derived soils (5-15) mg. kg^{-1},[7]. [8] mentioned that sedimentary rocks of sea origin have 500 mg. kg^{-1} or more. Rocks content of boron is 5- 10 mg. kg^{-1}, and 4- 5 mg. kg^{-1} its content in the oceans and seas, [9] . Soil boron has 4 forms that are: mineral boron, bound boron to organic matter, soluble boron in soil, and adsorbed boron. Boron that bound to mineral compounds is unavailable for plant absorption unless become soluble boron in soil solution, [10].

This study was conducted to find out the existence of boron in different layers of cultivated soils in central the Euphrates River in Iraq and the role of depthness and rivers declivity on its concentration. A few studies have been conducted in this area of Iraq about boron forms and its level in calcareous soils.

Materials and Methods

Soil pedon were determined in cultivated farms close to the main Euphrates River and its branches (Hilla and Al-Daghara rivers) in provinces ofKarbala, Babylon, Najaf, Diwaniyah, and Al-Muthana. 10 soil pedon were made in the mentioned provinces as followed:Soil pedon of adjacent area to the main Euphrates River were digged on counties of Twarije, Kufa, Gamas, and Al-Samawa, soil pedon of Missaib, Hashmiah, Diwaniyah, and Rumitha were done on farms that are close to the Hilla River, and soil pedon of Al-Daghara and Affak are belongs to the area of Al-Daghara River. Soil specimenswere taken of each diagnosticpedon layerfor laboratory examinations. Assessments of physical characteristics were done according to the following mentioned methods and their values are in the tables (1, 2, and 3).Soil particles volumes test was done by the pipette method to assess soil separators according to Day method, [11] . buik density was estimated by Core Sampler method, [11] . In the same way, chemical characteristics were estimated according to the following methods and their values are in the tables (4, 5, and 6). Electric connectivity in an extract soil to water (1:1) was measured by an Electrical Conductivity Bridge device, [12]. Power of hydrogen (pH)of an extract soil to water (1:1) was assessed by using pH-Meter device, [12] . Exchange capacity of positive ions were measured by ammonium acetate method 1.0 molar at (pH=7),[13] . Soil organic matter was estimated by using the method of wet digestion by titration it with ammonium ferrous sulphate according to Wikelly black methods, [12] . Gypsum was estimated by acetone sedimentation method,[14] . Carbone minerals were estimated by using Cacimeter device that based on calculation of Carbon dioxide that resulting of hydrochloric acid reaction 3N, which diluted with carbonates,[15] . Positive soluble ions of K^+, Na^+, Mg^+, Ca^+ in extraction (1:1). Ca^+ and Mg^+ were estimated by the titration method by using Na_2EDTA, [16]. Using a flame photometer device, K^+ and Na^+ were assessed, [14] . Negative soluble ions, carbonate and bicarbonate were measured by titration with On the other hand, chloride measured by titration with of $AgNO_3$, [16]. Carbonates were measured by using method with $BaCl_2$, then using the Spectrophotometer device, [11].

Total boron was estimated using burning method according to [16] then using the dual electric induction device.

Weight ratio of heavy to lightminerals in sand fraction

Two sites of Musayyib and Ramitha on the Euphrates River adjacent area (at the beginning and end of the section) were selected in order to study the presence of Tourmaline mineral and its effect on Boron abundance in soil. For the purpose of studying the ratios of heavy and light minerals and the diagnosis of Tourmaline percentage, soil samples were dismantled by hand with light hammering. Distilled water was then added and the soil samples disintegrated and dried. After drying, 15 g of each sample was taken washed on the 63 micron sieve in order to remove the clay and sludge and isolating sand separator for mineral analysis and mineral content calculation.

5 g of the sand fraction was taken to separate the heavy from the lightminerals by the heavy liquid of Bromoform. After separation, heavy and light minerals were weighed and the percentage of each fraction is extracted, [17] . table (7).

After the light minerals were isolated, they were washed by acetone for cleaning and purifying to be easily diagnosed by the polarized microscope. After washing, minerals were spread on glass slides and bonded with adhesive sandblast. Minerals were examined and diagnosed under the microscope and the percentage of each mineral was recorded. They were digitally imaged by a digital camera and each image measured by drawing scale using force of magnification and a micro-ruler, [18] . The following table (8) and images (1-6) show the types of minerals that were diagnosed and the percentages of each mineral.

Statistical analysis

Data was statistically analyzed [19] computing program.

Results and discussion

Total soil boron of the main Euphrates River adjacent soils

Table (9) shows total boron concentrations of the farms soil that are adjacent to the main

Euphrates river. Generally, there are a reduction in its concentration as going depth in soil body. The highest value of accumulation boronare at the first layer of depth on Al-Samawa location. The least value are at the thirddepthlayer on Twarije. Their values ranged between (1.03 and 11.43) mg. kg^{-1}.). The results in table (9) refer to that soil contents of total boron content are varied from one location to another, and it are also varied within location pedon layer. This may attribute this variation to the differences in: soil factors, original soil, potential of hydrogen, clay percentage, nature of location effecting factors, and level of ground water. Boron concentration increases directly with when potential of hydrogen (pH)rise up, and drops when pH decreases. The existence of carbonates in the soil leads to lower boron availability, which are the same with the other micro elements,[20].Samawa's soil farms soil has distinguished comparing with other, since it has highertotal boron content than other locations of the Euphrates river.

Total soil boron of the Hilla's River adjacent soils

Table (10) presents accumulation boron concentrations values. Results show a drop in values of boron concentration with depth in soil. The highest total boron value are at the first depth level at Missaib county (2.10) $mg.kg^{-1}$. The lowest value is at the third depth layer on Hashmiah county (12.91) $mg.kg^{-1}$, [21] . This values is less than the ones that [22] found when studied some of sedimentary soils. Soil content of total boron is among and within location, which due to nature of soil origin, its content of clay and organic matter since clay minerals and cation exchange capacity effecting boron existence, [23] .

Total soil boron of the Daghara's River adjacent soils

Total boron concentration are presented in table (11). Results clearly show drop in boron concentration values with depth. The highest boron content value was recorded at the surface layer of depth at Al-daghara county (14.65) $mg.kg^{-1}$. The least value was found at the fourth layer on Afak County (2.43) $mg.kg^{-1}$. On Al-daghara location, the fourth layer had higher boron content than the upper one because it are ground water limits table (11). These Values are higher than the values that [9] refers to. Soil content of boron are changed according to: soil sort, soil texture, soil humidity, and its organic matter content, [21]. Carbonates minerals is affecting boron availability since they bound it, [24].Total boron concentration is ranged between (1.03 – 12.91) mg. kg^{-1} for all of the studied soils. This study clarifies significant differences among and within locations.

Percentage of tourmaline mineral and its relation to total boron

Table (12) shows the percentages of tourmaline mineral of the Musayyib and al-Rumaitha soil sites. Results presents that tourmaline percentage was low in Musayyib site compared to Al-Rumaitha site. There values ranged from (1.0) to (1.4) %. The location of Rumaytha had a higher percentage of tourmaline than Musayyib, which ranged between (3.8 - 2.9). Higher Tourmaline percentage at Al-Rumaitha site is due to of the different source of wind sediments. The deposits of the Al-Rumaitha area in south-western Iraq originate from Saudi mountains, which are made up of tourmaline-rich pyramids. During weathering, erosion and transport, tourmaline is transported through the southwestern valleys of Iraq. Thus, the proportion of tourmaline is high at Al-Rumaitha , [25] . Tourmaline is one of the most minerals that contain boron in the soil. It contains 10% of boron. This mineral is resistant to weathering. Boron forms in mineral compounds are not readily available for plant absorption unless they degrade and become soluble in soil solution, [10] . The results of Table (12) show that the total values of boron were not consistent with the proportion of tourmaline as the increases or decreases. This shows that source of this element is not only of this mineral, but also other sources could provide it to the soil.Images (1-6) show the photos of tourmaline in Al-Rumaitha and Al-Musayyib sites. They show that this mineral was not subjected to extreme weathering since the edges of it smooth, which indicating the lack of boron contribution by this mineral to these soils.This may be due to the low severity of weathering factors because the study soils are located in dry and semi-arid soils, which reduces the contribution of the mineral in processing boron.Results indicate and confirm that the presence of tourmaline in the soil due to pollution not to the soil origin.

Table (1): Some of the physical characteristics of the soils of the main Euphrates River adjacent soils.

	Location	Depth Cm	Soil Separators mg. kg^{-1}			Soil texture	BuikDensity Mg. m^{-3}
			Silty	Loam	Clay		
1	Twarije	0-32	220	420	360	Clay loam	1.40
2		32-62	220	540	240	Silty loam	1.38
3		62-86	290	540	260	Loamy	1.42
4		86-120	310	440	250	Loamy	1.43
5	Kufa	0-31	210	440	350	Clay loam	1.39
6		31-60	180	370	450	Silty clay loam	1.42
7		60-120	270	450	280	Loamy	1.42
8	Gamas	0-49	240	510	250	Silty loam	1.38
9		49-90	240	385	375	Clay loam	1.42
10		90-115	320	430	250	Loamy	1.43
11	Al-Samawa	0-33	190	340	470	Clay	1.39
12		33-58	160	415	425	Silty clay	1.38
13		58-99	215	430	355	Clay loam	1.41
14		99-120	225	405	370	Clay loam	1.42

Table (2): Some of the physical characteristics of the soils that are adjacent to the Hila River.

	Location	Depth cm	Soil Separators mg. kg^{-1}			Soil texture	Buik Density Mg. m^{-3}
			Silty	Loam	Clay		
1	Missaib	0-39	250	300	450	Clay	1.41
2		39-64	165	410	425	Silty clay	1.40
3		64-98	165	440	395	Silty clay loam	1.40
4		98-125	166	450	384	Silty clay loam	1.41
5	Hashmiah	0-34	280	460	260	Loamy	1.40
6		34-62	205	440	355	Silty loam	1.42
7		62-115	300	470	230	Loamy	1.43
8	Diwaniyah	0-35	166	441	393	Silty clay loam	1.39
9		35-69	168	460	372	Silty clay loam	1.40
10		69-130	220	410	370	Clay loam	1.42
11	Rumitha	0-49	190	405	405	Silty clay	1.38
12		49-72	170	410	420	Silty clay	1.39
13		72-100	170	445	385	Silty clay loam	1.40

Table (3): Some of the physical characteristics of the soils that are adjacent to the Al-Daghara River.

	Location	Depth cm	Soil Separators mg. kg^{-1}			Soil texture	Buik Density Mg. m^{-3}
			Silty	Loam	Clay		
1	Al-Daghara	0-24	210	360	425	Clay	1.39
2		24-54	175	415	410	Silty clay	1.40
3		54-85	180	400	420	Silty clay	1.41
4		85-110	165	440	395	Silty clay loam	1.41
5	Affak	0-21	220	520	260	Silty loam	1.38
6		21-47	210	380	410	Clay loam	1.42
7		47-76	230	375	395	Clay loam	1.43
8		76-110	195	435	370	Silty clay loam	1.42

Table (4): Some of the chemical characteristics of the soils that are adjacent to the main Euphrates River.

	Location	Depth Cm	EC ds.m^{-1}	pH	C molc. kg^{-1}								CEC ds.m^{-1}	Carbonates minerals	O.M	Gypsum
					Ca^{+2}	Mg^{+2}	Na^{+2}	K^{+1}	SO_4^{-2}	Cl^{-1}	HCO_3^{-1}	CO_3^{-1}		Gm.kg^{-1}		
1	Twarije	0-32	4.50	7.78	1.40	1.05	2.46	0.033	0.60	1.70	0.53	Nill	27.83	239	11.61	4.16
2		32-62	2.99	7.71	0.9	0.65	1.65	0.032	0.42	0.99	0.20	Nill	33.12	221	9.20	4.38
3		62-86	3.49	7.80	0.92	0.91	1.94	0.029	0.48	1.10	0.30	Nill	23.36	235	7.41	1.13
4		86-120	2.578	7.75	0.81	0.55	1.61	0.030	0.40	0.97	0.21	Nill	22.67	216	7.00	2.26
5	Kufa	0-31	1.808	7.60	0.53	0.45	1.02	0.023	0.25	0.63	0.16	Nill	30.35	271	10.89	0.51
6		31-60	3.506	7.68	0.94	0.94	1.96	0.026	0.28	1.09	0.31	Nill	32.78	293	8.71	0.69
7		60-120	2.06	7.59	0.67	0.43	1.05	0.024	0.26	0.8	0.15	Nill	24.00	278	6.53	0.34
8	Gamas	0-49	2.224	7.80	0.87	0.82	1.79	0.020	0.38	1.22	0.27	Nill	33.54	255	11.23	0.90
9		49-90	3.154	7.72	0.84	0.78	1.75	0.062	0.37	1.20	0.26	Nill	30.06	286	8.37	0.49
10		90-115	2.46	7.85	0.78	0.53	1.26	0.031	0.29	0.89	0.20	Nill	23.81	269	7.15	0.81
11	Al-Samawa	0-33	2.57	7.65	0.82	0.56	1.63	0.030	0.40	0.97	0.22	Nill	41.31	292	15.30	3.43
12		33-58	4.00	7.59	1.38	0.87	2.13	0.035	o.58	1.37	0.34	Nill	37.53	262	12.08	2.81
13		58-99	3.20	7.63	0.91	0.89	1.76	0.017	0.37	1.20	0.26	Nill	33.19	230	9.18	2.23
14		99-120	2.05	7.60	1.24	0.92	2.38	0.029	0.53	1.50	0.34	Nill	34.40	246	7.30	0.87

Table (5): Some of the Chemical characteristics of the soils that are adjacent to the Hila River.

	Location	Depth Cm	EC ds.m^{-1}	pH	C molc. kg^{-1}								CEC ds.m^{-1}	Carbonates minerals	O.M	Gypsum
					Ca^{+2}	Mg^{+2}	Na^{+2}	K^{+1}	SO_4^{-2}	Cl^{-1}	HCO_3^{-1}	CO_3^{-1}		Gm.kg^{-1}		
1	Missaib	0-39	14.22	7.68	4.23	3.92	7.55	0.046	1.88	4.98	1.34	Nill	39.58	336	13.84	2.50
2		39-64	5.10	7.72	1.54	1.23	2.70	0.04	0.64	1.84	0.46	Nill	36.36	281	10.22	2.79
3		64-98	4.60	7.79	1.44	1.09	2.53	0.033	0.60	1.71	0.38	Nill	34.25	289	8.30	1.34
4		98-125	4.36	7.70	1.35	1	2.36	0.033	0.27	1.66	0.51	Nill	34.88	252	7.14	0.75
5	Hashmiah	0-34	7.40	7.63	2.03	1.70	4.13	0.032	1.05	2.66	0.63	Nill	21.36	270	9.78	1.69
6		34-62	10.74	7.69	3.22	2.82	5.86	0.039	1.43	4.03	0.87	Nill	23.00	278	6.29	2.38
7		62-115	1.832	7.61	0.59	0.39	0.88	0.022	0.22	0.69	0.14	Nill	22.18	246	6.00	1.08
8	Diwaniyah	0-35	5.19	7.38	1.55	1.20	2.83	0.034	0.65	1.89	0.42	Nill	33.65	294	12.73	0.76
9		35-69	8.18	7.46	2.41	2.14	4.66	0.045	1.10	3.30	0.16	Nill	34.12	132	8.25	0.85
10		69-130	6.62	7.42	2.32	1.46	3.63	0.032	0.97	2.41	0.52	Nill	31.65	240	7.12	0.46
11	Rumitha	0-49	3.69	7.55	1.22	0.87	2.38	0.026	0.53	1.54	0.32	Nill	36.28	278	14.12	0.28
12		49-72	3.32	7.51	0.91	0.85	1.78	0.02	0.38	1.22	0.28	Nill	37.40	246	11.45	0.56
13		72-100	4.14	7.63	1.26	0.94	2.40	0.024	0.54	1.56	0.33	Nill	33.74	228	8.26	0.24

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Table (6): Some of the chemical characteristics of the soils that are adjacent to the Al-Daghara River.

	Location	Depth Cm	EC $ds.m^{-1}$	pH	C molc. kg^{-1}								CEC $ds.m^{-1}$	Carbonates minerals	O.M	Gypsum
					Ca^{+2}	Mg^{+2}	Na^{+2}	K^{+1}	SO_4^{-2}	Cl^{-1}	HCO_3^{-1}	CO_3^{-1}		Gm.kg^{-1}		
1	Al-Daghara	0-24	2.10	7.56	0.69	0.48	1.04	0.027	0.26	0.80	0.15	Nill	38.69	235	14.65	1.23
2		24-54	4.14	7.51	1.30	0.99	2.46	0.025	0.55	1.57	0.34	Nill	35.17	289	9.82	1.40
3		54-85	3.68	7.60	0.99	0.91	2.03	0.31	0.44	1.32	0.32	Nill	36.26	294	8.59	0.82
4		85-110	3.20	7.58	0.89	0.80	1.7	0.032	0.37	2.07	0.53	Nill	32.18	250	7.29	0.60
5	Affak	0-21	6.48	7.81	2.18	1.36	3.62	0.028	0.93	2.32	0.51	Nill	22.30	285	10.33	0.42
6		21-47	6.66	8.03	2.25	1.4	3.74	0.036	0.95	2.34	0.55	Nill	29.06	261	9.29	0.31
7		47-76	5.56	7.88	1.71	1.31	3.22	0.026	0.70	2.07	0.52	Nill	27.85	279	8.10	0.38
8		76-110	4.12	7.83	1.23	0.91	2.38	0.025	0.53	1.57	0.35	Nill	30.18	257	6.23	0.26

Table (7) Percentage of heavy and light minerals for Al-Rumaitha and Al-Masib
(Estimated in the laboratories of the College of Science, University of Baghdad)

Loction	Depth (cm)	Sample Weight (g)	Light Minerals Weight(g)	Light Minerals %	Heavy Minerals Weight(g)	Heavy Minerals %
Rumaitha	49–0	5	4.82	96.4	0.18	3.6
	49-72	5	4.84	96.8	0.16	3.2
	72-100	5	4.86	97.2	0.14	2.8
Musayyib	39–0	5	4.88	97.6	0.12	2.4
	64–39	5	4.85	97	0.15	3
	98–64	5	4.83	96	0.17	3.4

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Table (8) Mineral composition and percentage of tourmaline mineral for sand minerals at Musayyib and Rumaytha sites
(Estimated at the laboratories of the College of Science, University of Baghdad)

Light Minerals and Components	Levels Depth					
	Rumaitha			Musayyib		
	0- 49	49-72	72-100	0-39	39-64	64-98
Monocrystalline Quartz	30.5	30.3	31.5	30.5	31.4	30.3
Polycrystalline Quartz	3.1	2.4	2.2	2.7	3.4	2.2
Alkali Feldspar (Orthoclase)	1.2	1.5	1.3	1.5	1.3	1.5
Alkali Feldspar (Microcline)	1.1	1.3	1.4	1.1	1.4	1.8
Plagioclase Feldspar	1.4	1.3	1.5	1.9	1.5	1.6
Carbonate Rock Fragments	32.4	32.4	33.3	28.7	32.4	33.7
Chert Rock Fragments	15.7	14.1	14.9	13.3	16.2	11.5
Igneous Rock Fragments	1.2	1.5	1.6	1.2	1.3	1.8
Metamorphic Rock Fragments	1.2	1.2	1.8	1.6	1.2	1.7
Mudstone Rock Fragments	5.2	5.3	5.6	5.0	5.1	4.7
Evaporates	3.1	3.7	3.7	3.9	3.9	3.3
Others	1.0	1.7	2.5	1.5	1.8	1.3
Heavy Minerals	**Levels Depth**					
	0-49	49-72	72-100	0-39	39-64	64-98
Opaques (Iron Oxides)	36.4	46.0	46.4	44.1	44.2	48.5
Chlorite	5.2	5.8	5.6	5.8	4.7	5.2
Rutile	3.8	5.7	4.0	5.0	5.3	5.9
Zircon	6.2	6.9	9.9	8.7	9.9	8.2
Pyroxene	7.5	6.2	5.3	4.5	4.9	4.7
Amphibole	7.5	7.9	4.8	4.4	4.7	5.2
Biotite	4.4	4.4	3.5	3.6	3.6	4.6
Muscovite	7.5	7.8	8.7	7.9	7.9	8.5
Tourmaline	3.8	2.9	3.2	1.2	1.4	1.0
Epidote	5.9	5.7	5.8	6.8	5.9	5.8
Garnet	4.4	4.7	4.7	3.7	3.5	4.6
Kyanite	1.1	1.1	1.7	2.1	2.1	2.1
Others	1.0	2.1	1.1	1.3	2.2	1.3

Al-Qadisiyah Journal of Agriculture Sciences (QJAS)- Vol.8 NO.2 (2018)
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Table (9): Total boron values of the soils that are adjacent to the main Euphrates River.

	Location	Depth cm	Total boron $mg.kg^{-1}$
1	Twarije	0-32	4.451
2		32-62	3.163
3		62-86	1.033
4		86-120	1.367
5	Kufa	0-31	2.352
6		31-60	2.771
7		60-120	1.146
8	Gamas	0-49	4.811
9		49-90	2.306
10		90-115	1.250
11	Al-Samawa	0-33	11.432
12		33-58	6.903
13		58-99	3.365
14		99-120	3.177
LSD values: Location = 0.0005*, Depth = 0.0002* Location and depth interaction =0.0008*			

Table (10): Total boron values of the soils that are adjacent to the Hilla River.

	Location	Depth cm	Total boron $mg.kg^{-1}$
1	Missaib	0-39	12.912
2		39-64	10.536
3		64-98	2.325
4		98-125	2.869
5	Hashmiah	0-34	5.752
6		34-62	3.230
7		62-115	2.106
8	Diwaniyah	0-35	8.768
9		35-69	3.145
10		69-130	3.420
11	Rumitha	0-49	9.688
12		49-72	10.423
13		72-100	7.316
LSD values: Location = 0.0004*, Depth = 0.0001* Locationand depth interaction =0.0006*			

Table (11): Total boron values of the soils that are adjacent to the Al-Daghara River.

	Location	Depth Cm	Total boron mg.kg^{-1}
1	Al-Daghara	0-24	14.658
2		24-54	9.543
3		54-85	5.661
4		85-110	6.374
5	Affak	0-21	7.633
6		21-47	4.748
7		47-76	3.912
8		76-110	2.430
LSD values: Location = 0.0004*, Depth = 0.0001* Location and depth interaction =0.0005*			

Table (12): Percentage of tourmaline and total boron values in the levels of Musayyib and Rumaytha soils.

Location	DepthCm	Tourmaline%	Total Boronmg.kg^{-1}
Musayyib	0–39	1.2	12.912
	39–64	1.4	10.536
	64–98	1.0	2.325
Rumaytha	0–49	3.8	9.688
	49-72	2.9	10.423
	72-100	3.2	7.316

image (1) tourmaline mineral for the first horizon (Rumaitha location)
Honey color, pleochroic, prismatic form tourmaline, sample number R1, PPL.

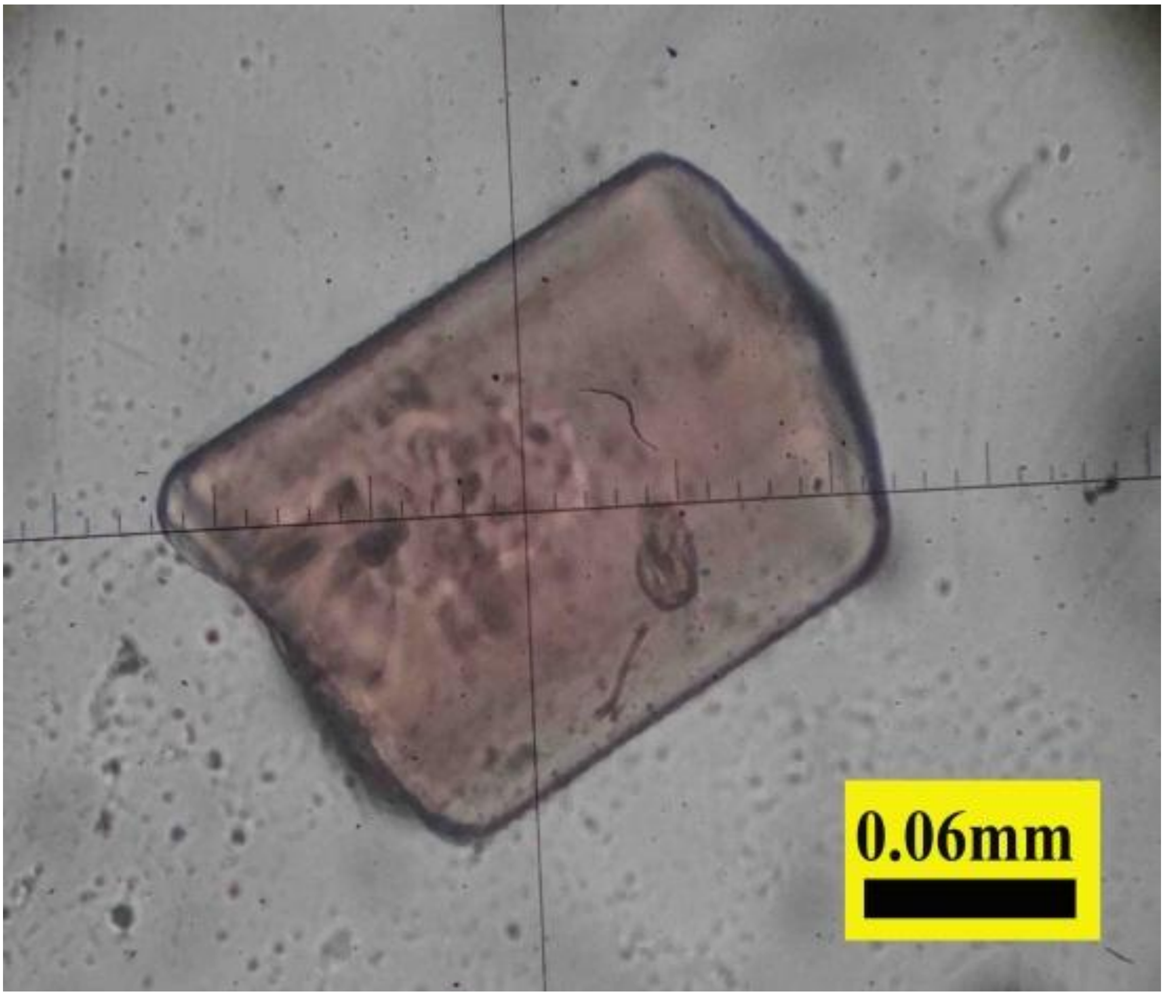

image (2) tourmaline mineral for the second horizon(Rumaitha location)
Pleochroic light brown color tourmaline, sample number R2, PPL.

Al-Qadisiyah Journal of Agriculture Sciences (QJAS)- Vol.8 NO.2 (2018)
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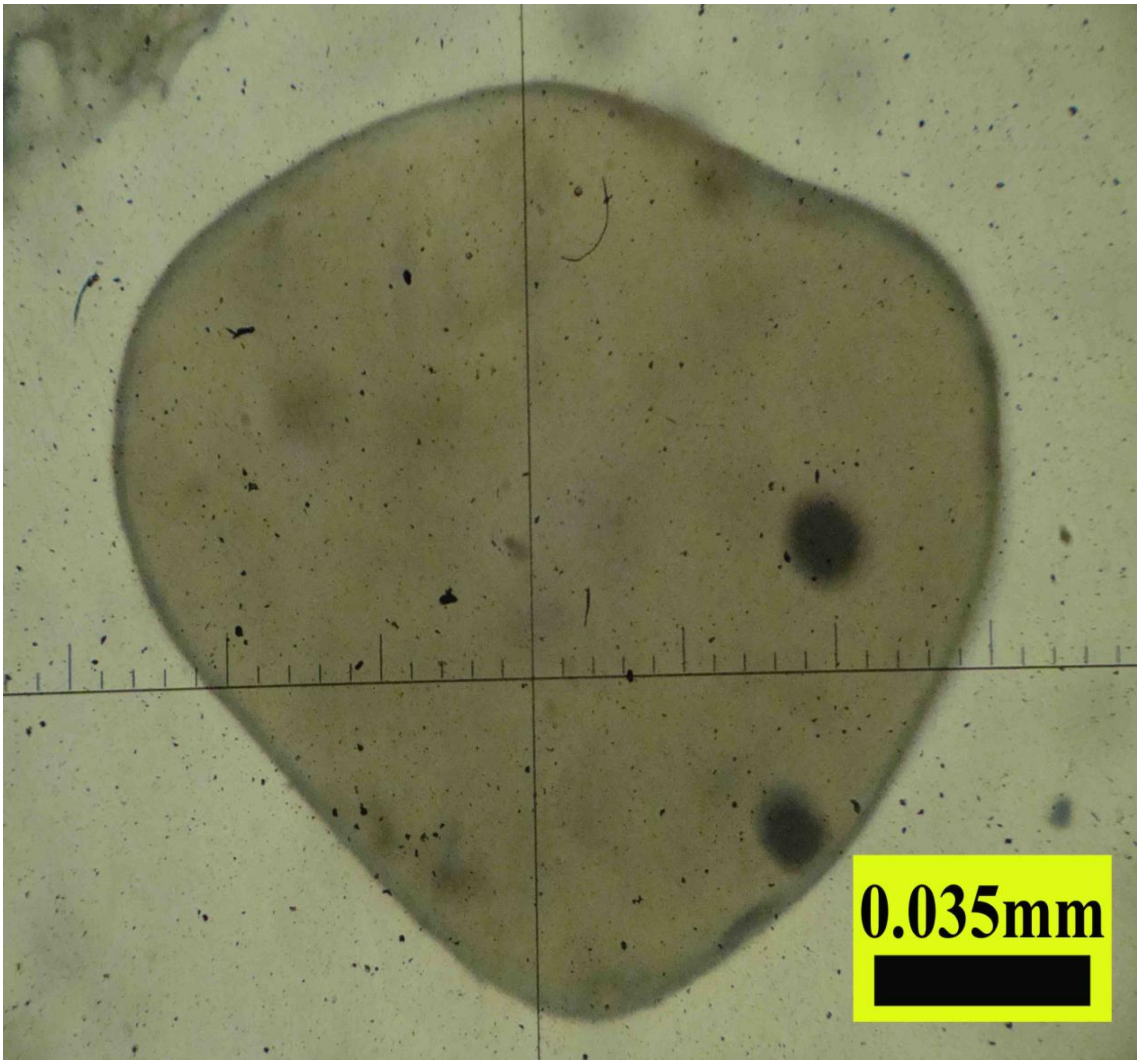

image (3) tourmaline mineral for the third horizon(Rumaitha location)
Pleochroic light brown color tourmaline, sample number R3, PPL.

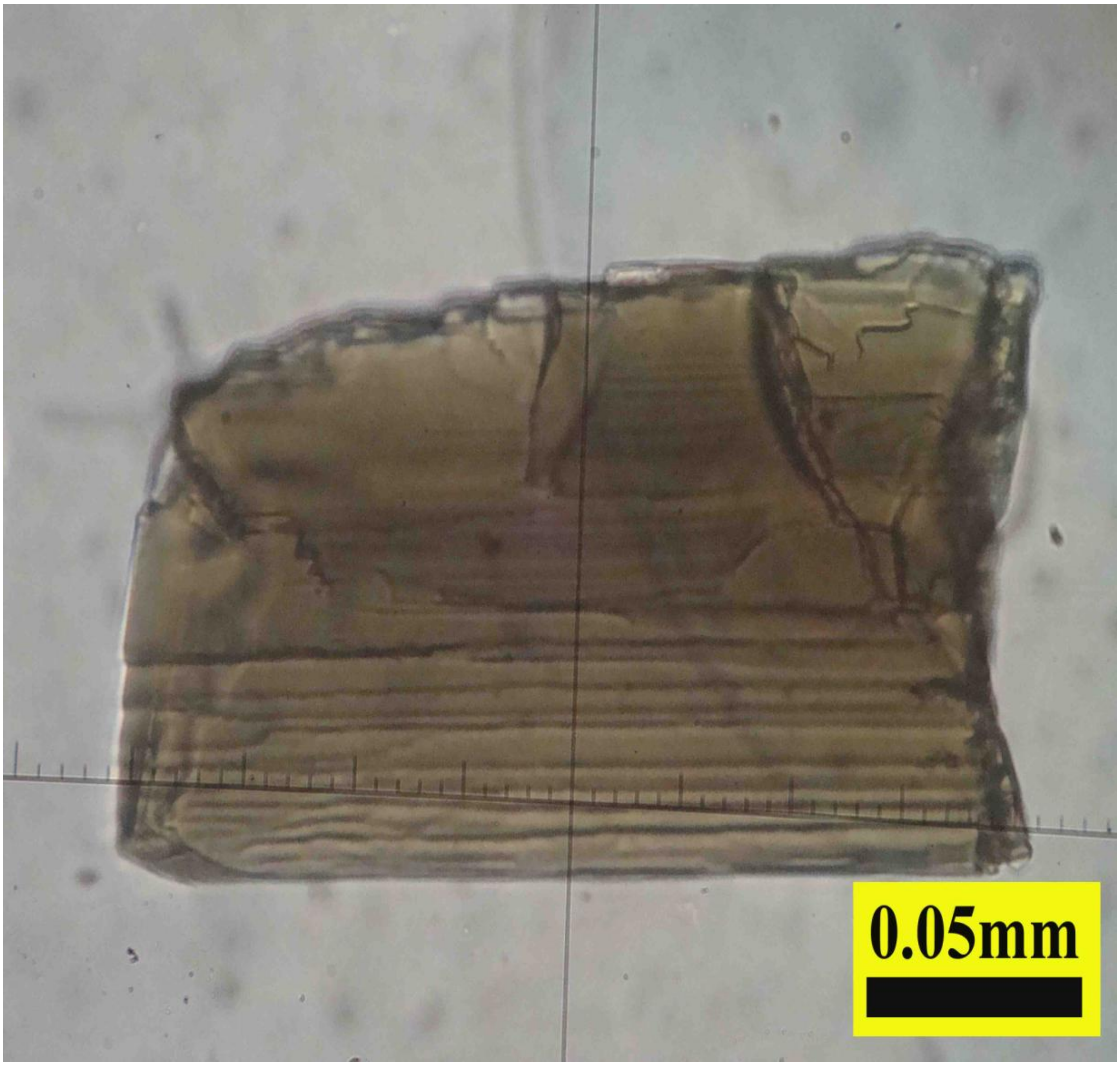

image (4) tourmaline mineral for the first horizon(Musayyib location)
Pleochroic light brown color tourmaline, sample number M1, PPL.

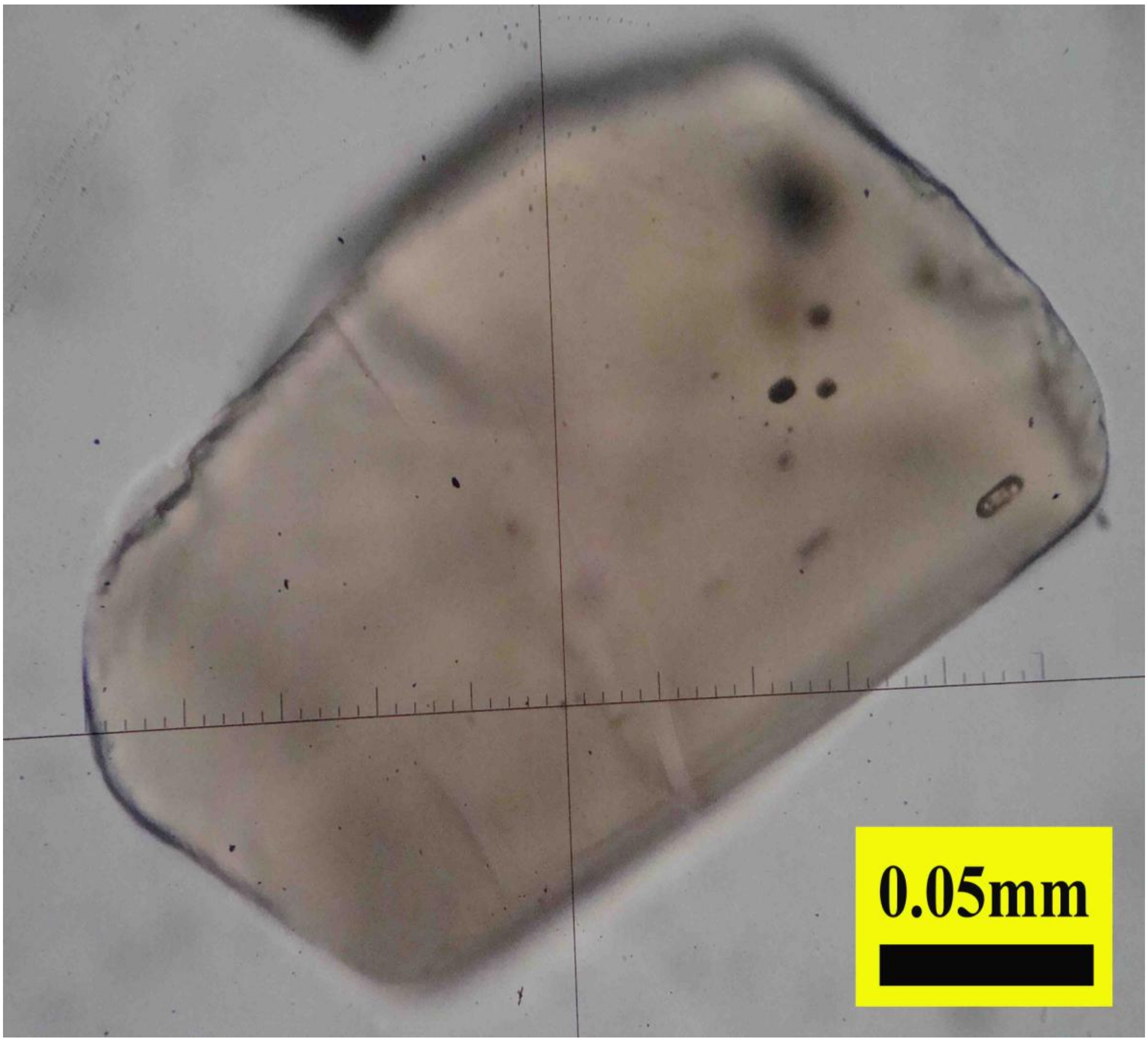

image (5) tourmaline mineral for the second horizon(Musayyib location)
Honey pleochroic color tourmaline, sample number M2, PPL.

image (6) tourmaline mineral for the third horizon(Musayyib location)
Pleochroic light brown color tourmaline, sample number M3, PPL.

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دور الانحدار والعمق في تركيز البورون الكلي في ترب بعض محافظات العراق

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الخلاصة

بهدف دراسة تأثير الانحدار وعمق البيدونات في تركيز عنصر البورون الكلي في منطقة الفرات الاوسط / العراق والممثلة لترب السهل الرسوبي و تضمنت مواقع الدراسة محافظــات (كربلاء - بابل – النجف – الديوانية – المثنى) حيث تم أخذ البيدونات من ترب مزروعة مجاورة لمقاطع الانهار وهي مقطع نهر الفرات الرئيسي ومقطع شط الحلة ومقطع شط الدغـارة اذ تم اخذ عشر بيدونات من المحافظات اعلاه وكما يأتي بيدونات مقطع نهر الفرات الرئيسي وتشمل (طويريج ،كوفة ، غماس ، السماوة) ، بيدونات مقطع شط الحلة وتشمل (مسيب ، هاشمية ، ديوانية ، رميثة) ، بيدونات مقطع شط الدغارة وتشمل (الدغارة ، عفك). أظهرت النتائج انخفاض تراكيز البورون الكلي لترب الدراسة مع زيادة اعماق الآفاق ولمواقع الدراسة كافة إذ ان قيم البورون كانت الاعلى في الطبقة السطحية ثم انخفضت مع العمق ما عدا تربتي السماوة والرميثة. ان اعلى قيمة للبورون الكلي تراوحت من (14.658 - 1.033) ملغم.كغم$^{-1}$ في جميع الترب المدروسة. كما اظهرت النتائج ان قيم البورون الكلي لم ترتبط بالنسبة المئوية لمعدن التورمالين في جميع المواقع.

الكلمات المفتاحية :بورون التربة ، بيدون التربة ، انحدار النهر ، اختزال البورون ، اجمالي البورون .

* البحث مستل من رسالة ماجستير للباحث الثاني.