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Geochemical Assessment of Trace Element in Core Sediments from Hor Al-Ezaim, Southern Iraq.

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Abstract

The paper presents document regarding concentration, distribution and possible sources of selected trace elements; Cd, Zn, Mn, Co, and V by using Atomic absorption in core sediments from Hor Al-Ezaim in Hor AL-Huwaiza, southern Iraq. The levels of elements showed a wide range of variations in different core depths. Contamination Factor (CF) and geo-accumulation index (I_{geo}) were calculated to understand the pollution status of the study area based on the background values. All the levels of trace elements in the sediment core samples were low, which indicates minimum pollution in these areas. Concentrations of these pollutants could be due to natural and anthropogenic sources.

1- Introduction

Trace metals enter southern Iraqi marshes from both natural and anthropogenic sources (Al-Saad *et al.*, 2010). Natural sources include storm dust falls, erosion or crustal weathering and decomposition of the biota in the water. Whereas the anthropogenic sources include sewage wastes, industrial effluent, automobile effluent, petroleum and fertilizer industry effluent (Al-Maarofi *et al.*, 2012). Trace metals are also incorporated into the food chain from fish either from water via gills or from sediments and marine organisms via the gut track (Abaychi and Al-Saad, 1988).

The determination of trace metals in recently deposited sediments is a useful tool in the assessment of status of environmental pollution as the surficial sediments are potentially good indicators of the quality of overlying waters .Once trace metals were discharged into coastal waters, they rapidly become associated with particulates and incorporated in bottom sediments (Al-Haidarey *et al.*, 2010).

The trace metals associated with sediments are not essentially sheltered permanently, under changing environmental conditions they may be released to the water column by various processes of remobilization. Thus in aquatic system, sediments may be both a carrier and a possible source of metals. Atmospheric deposition of air pollutants from industrial areas, however, can also add a significant trace element as indicated by trace element levels in rainwater and the sediment cores (Al-Taei, 2013).

Sediments represent an important sink for trace metals in aquatic systems, and metal concentrations in sediment can be in several orders of magnitude greater than in the overlying water. Over the past decade, although there have been an increasing attention to persistent organic contaminants, greenhouse gases and global warming, toxic heavy metals in the aquatic environment remain an enduring threat. Continued introduction of metals into the aquatic environment by industrial processes, domestic practices and mining have ensured that the levels of contamination continue to be a problem. Anthropogenic emissions of heavy metals exceed the fluxes from natural sources (Chatterjee *et al.*, 2007). The Iraqi marshlands are one of the finest and most extensive natural wetland ecosystems in Europe and western Asia (Evans, 2002). Around 85% of the Mesopotamian Marshlands have been lost mainly as a result of drainage and damming (UNEP, 2005). Most of the damage was done between 1991 and 1995, and most dramatic change occurred between 1993 and 1994 (the vegetation cover was reduced by 79 %) (Munro & Touron, 1997). Currently, restoration by refolding of drained marshes is proceeding, and the ecological effects of this massive water diversion need elaborated research. Hence, the refolding of southern Iraq's Mesopotamian marshes is now a giant ecosystem-level experiment (Richardson & Hussain, 2006).

The present study focuses on the determinationand abundance of trace metals (Co, Cd, Mn, Zn and V) in the sediments core of Al-hawaiza marshes in southern Iraq.

2- Materials and methods

Sediment cores from two locations in Al-Ezaim Hor Al-Huwaiza during 2012 (Fig .1).

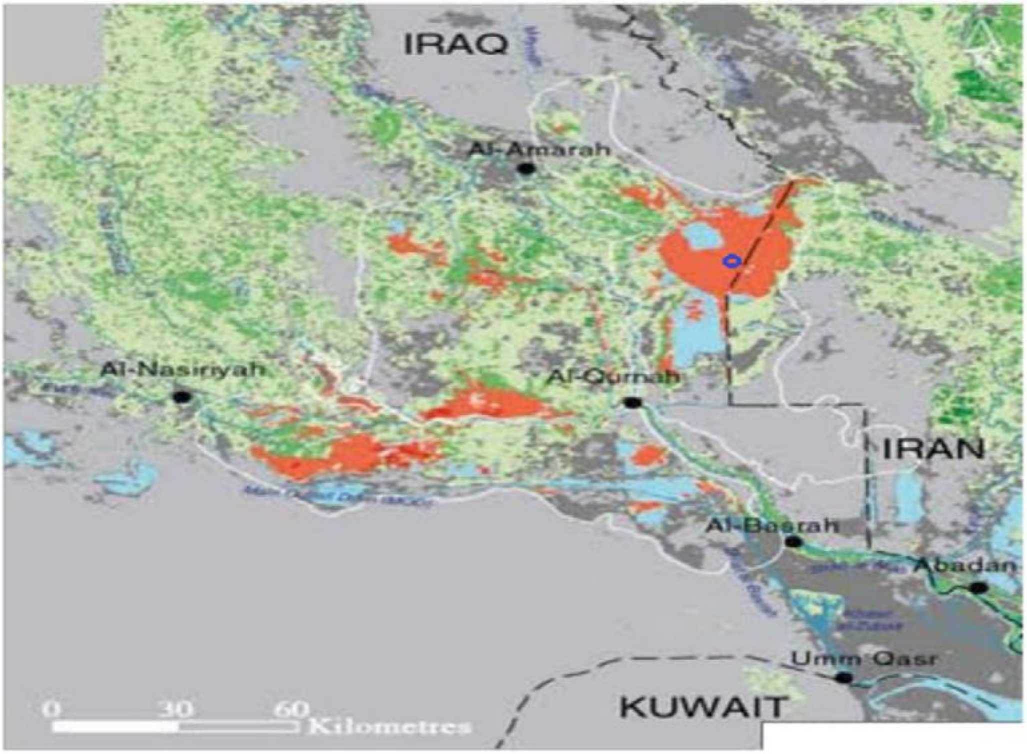

Fig. 1: Sample locations

Hand corer (Perspex tube 5cm i.d., 1 m length) was employed. Upon collection, each core was subdivided to 5cm in the length by transverse section, after being freed from coarse shell fragments, visible organism, and plant leaves and roots. Samples were stored in labeled polyethylene bags at 20c. The samples were then freezedried, ground and homogenized using a Retch type RMO.

Trace elements counted of sediment samples were determined following a procedure described by Sturgeon *et al.* (1982). This method entails the treatment of the sediment with a 1:1 mixture of concentrated HCl and HNO_3 acids. After evaporation to near dryness the digestion was further proceeded with a 1:1 mixture of concentrated $HClO_3$ and HF acids, which were again evaporated to near dryness. The residues were dissolved in 0.5N HCl. For, the analysis of these metals done by using Atomic Absorption instrument. A procedural blank consisting of reagent, glassware and sediment samples during the analysis were periodically determine.

3- Results and Discussion

Distribution of trace elements in sediment core showed variations in concentration with depth. The mean values of the element in the sediment range for: Co (40-62), Cd (20-58), Mn (500-638), Zn (50-120) and for V (53-95) µg/g dry weight (Table 1). Mn showed the highest mean concentration in the sampling stations. The Maximum mean concentration values for Co (62 µg/g), Cd (58 µg/g), Zn (120 µg/g) and V (95 µg/g) were obtained in the sediment core, these came from many sources such as the Intensive fishing and sewage drainage from the marsh land and other commercial activities are supposed to be potential sources for the enrichment of these elements in the area. The concentrations of all the elements showed pronounced Variations between the elements, An overall increasing value from top to bottom core is also noticed (Fig. 2) that should be attributed to ground water infiltration derived from multi-sources. It can observe from this table, the concentrations of trace elements in the top (0-5 cm) section are relatively higher than other section of the same core. Trace elements enter the aquatic environment of southern Iraq from both natural and anthropogenic sources (Al-Hadiary 2009, Al-Hadiary *et al.*, 2010 and Al-saad *et al.*, 2010). Natural sources include storm dust fall, erosion or crusted weathering and dead and decomposition of the biota in the water, whereas the anthropogenic sources include sewage wastes, industrial effluent, automobile effluent, petroleum and industry effluents (Al-Hadiary, 2009).

The sedimentations (traps by an aquatic macrophyts or physically sedimentation) and consumptions (by aquatic plants, phytoplankton, and other aquatic organisms) of trace elements lead to sinking of some amounts of elements while the others will transform out of the Marsh. Al-Hawizeh Marsh was source of some elements (Cd, Zn, Mn, Co and V), that was depended on the forms of elements (marsh can sinks for an inorganic form and source of an organic form of same elements Al-Haidarey, 2009) and also the anthropogenic activity such as the (agriculture, industrial wastes, and military stocks that came from the Iraq-Iranian war and weather. Atmospheric deposition of air pollutants from industrial areas, however, can also add a significant trace element burden to high altitude marshes as indicated by trace element levels in the sediment cores.

According to Loska *et al.* (1997) and Gonzales-Macias *et al.* (2006), the contamination level may be classified in a scale ranging from 1 to 6 ($I_{geo} \leq 0$ = unpolluted, $I_{geo} < 1$ = unpolluted to moderately polluted, $I_{geo} < 2$ = moderately polluted, $I_{geo} < 3$ = moderately to strongly, $I_{geo} < 4$ = strongly polluted, $I_{geo} < 5$ = strongly to very strongly polluted,

$I_{geo} > 5$ = very strongly polluted). To gauge the degree of anthropogenic influence on heavy metals concentration in the sediments used Igeo (Muller, 1979), are shown in Table 2 and Fig. 3 the Igeo were arrange as fellows: Cd>V>Co>Zn>Mn. Present results of geo-accumulation index (Table 2 and Fig. 3) reveal that sediments of Hor Al-Ezaim are remaining unpolluted for Co, Mn and Zn as most of the I_{geo} values are less than 1.

CF is the ratio between the sediment metal concentration at a given site and the background value of the metal. CF is considered to be an effective tool in monitoring the pollution over a period of time. CF of different heavy metals has revealed that different metals have different levels of accumulation viz. Co (1.6–2.48), Cd (200–386.6), Mn (0.515–0.67), Zn (0.714–1.714) and V (19.62–35.18). However CF for elements were also found as Cd>V>Co>Zn>Mn (Table 3 and Fig.4) and it can be ascribed to the influence of external discrete sources like sewage and agricultural runoff or can result from intense fishing and boating activities across the marshes throughout the year .

Table (1): The concentration of trace elements (µg/g) in Sediment core of Hor Al-Ezaim

Core I depth (cm)	Co	Cd	Mn	Zn	V
(0-5)	62	58	638	120	95
(5-10)	48	45	632	111	73
(10-15)	43	40	620	198	70
(15-20)	42	48	580	98	68
(20-25)	44	50	593	96	67
(25-30)	42	53	560	90	60
(30-35)	53	60	553	89	58
(35-40)	58	62	550	70	53
(40-45)	60	53	530	66	70
(45-50)	44	44	523	76	72
(50-55)	42	40	500	55	68
(55-60)	38	48	490	50	70
(60-65)	40	30	520	69	89
(65-70)	42	28	570	53	73
(70-75)	44	36	538	50	70
(75-80)	43	20	520	52	56

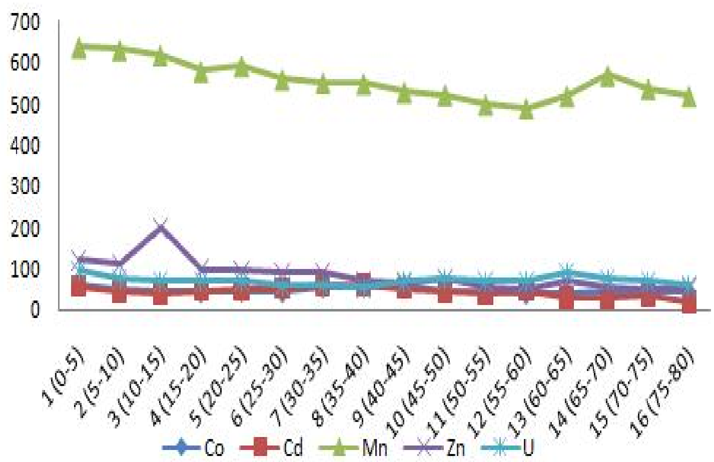

Fig. (2): Down core variations in trace element of Sediment core of Hor Al- Ezaim

Table (2). Geochemical index of trace element in Sediment core of Hor Al-Huwaiza

Geochemical index					
Core I depth (cm)	**igeo**	**igeo**	**igeo**	**igeo**	**igeo**
(0-5)	0.49	77.33	0.13	0.34	7.03
(5-10)	0.38	60	0.13	0.31	5.40
(10-15)	0.34	53.33	0.13	0.56	5.18
(15-20)	0.33	64	0.12	0.28	5.03
(20-25)	0.35	66.66	0.12	0.27	4.96
(25-30)	0.33	70.66	0.11	0.25	4.44
(30-35)	0.42	80	0.11	0.254	4.29
(35-40)	0.46	82.66	0.11	0.2	3.92
(40-45)	0.48	70.66	0.11	0.18	5.18
(45-50)	0.35	58.66	0.11	0.21	5.33
(50-55)	0.33	53.33	0.10	0.15	5.03
(55-60)	0.30	64	0.10	0.14	5.18
(60-65)	0.32	40	0.10	0.19	6.59
(65-70)	0.33	37.33	0.12	0.15	5.40
(70-75)	0.35	48	0.11	0.14	5.18
(75-80)	0.34	26.66	0.10	0.14	4.14

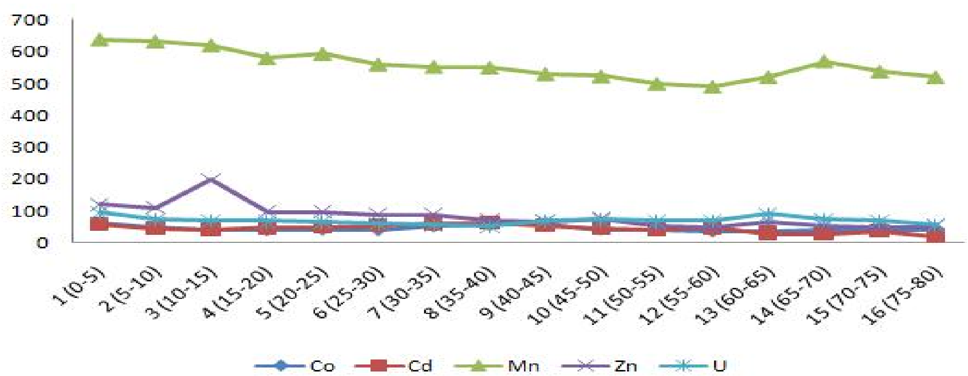

Fig. (3). Geochemical index profile of trace element in Sediment core of Hor Al- Ezaim

Table (3). The concentration facter of trace elements in Sediment core of Hor Al-Ezaim

CON.Factor					
Core I depth (cm)	**con. Co**	**con. Cd**	**con. Mn**	**con. Zn**	**con.V**
(0-5)	2.48	386.66	0.67	1.71	35.18
(5-10)	1.92	300	0.66	1.58	27.03
(10-15)	1.72	266.66	0.65	2.82	25.92
(15-20)	1.68	320	0.61	1.4	25.18
(20-25)	1.76	333.33	0.62	1.37	24.81
(25-30)	1.68	353.33	0.58	1.28	22.22
(30-35)	2.12	400	0.58	1.27	21.48
(35-40)	2.32	413.33	0.57	1	19.62
(40-45)	2.4	353.33	0.55	0.94	25.92
(45-50)	1.76	293.33	0.55	1.08	26.66
(50-55)	1.68	266.66	0.52	0.78	25.18
(55-60)	1.52	320	0.51	0.71	25.92
(60-65)	1.6	200	0.54	0.98	32.96
(65-70)	1.68	186.66	0.60	0.75	27.03
(70-75)	1.76	240	0.56	0.71	25.92
(75-80)	1.72	133.33	0.54	0.74	20.74

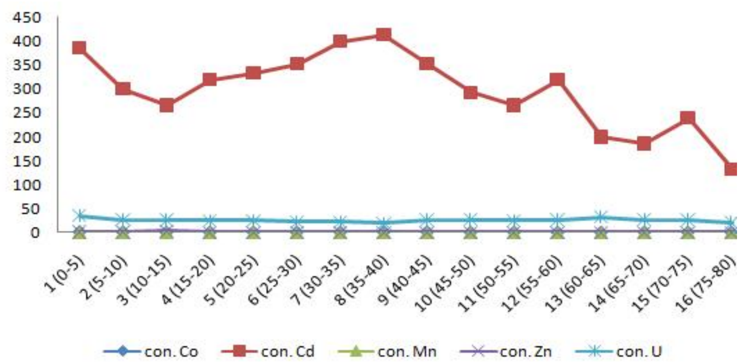

Fig. (4): The concentration facter profile of trace elements(μg /g) in Sediment core of Hor Al-Ezaim

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التقدير الجيوكيميائي للعناصر النزرة لرواسب لبابية من هور العظيم-جنوب العراق

عباس حميد البيضاني
قسم علم الارض-كلية العلوم-جامعة البصرة

الخلاصة

تضمنت هذة الدراسة تراكيز وتوزيع والأصل المحتمل لبعض **العناصر النزرة** (الكادميوم . **الزنك** . المنغنيز. **الكوبلت** والفاناديوم) لعينات لبابية من هور العظيم في هور الحويزة-جنوب العراق باستخدام جهاز الامتصاص الذري.اظهرت مستويات تراكيز هذة المعادن اختلافا بالتوزيع مع العمق .درس معامل التلوث ودليل التجمع الجيوكيميائي لبيان حالة **التلوث في المنطقة**، أوضحت الدراسة بان معظم تراكيز العناصر النزرة في الرواسب اللبابية الماخوذة للمنطقة ذات تلوث قليل وان مصادر هذة الملوثات تتأتي من مصادر متنوعة منها الطبيعية والبشرية.