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Distributions and Sources of Heavy Metals in Exchangeable and Residual sediment core in Shatt AL-Basrah Canal

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Abstract:

The current study deal with the measurement of heavy metals pollution in sediment core at six stations taken from Shatt AL-Basra, these metals (lead, nickel, copper, chromium, zinc, cobalt, cadmium, and iron) were determined in the Exchangeable and residual phase by using the In conductivity Coupled Plasma (ICP). The percentage of total organic carbon and grain size analysis were also determined. The results of the concentrations in the Exchangeable phase of (Pb, Ni, Cu, Cd, Zn, Cd, Co, and Fe) showed that the highest concentration was (4.24, 8.15, 27.23, 10.33, 14.65, 0.79, 80.18, 900) µg/ gram dry weight respectively while the lowest concentration was (2.5, 1.16, 1.7, 56.06, 16.82, 0.02, 9.13, 43.5 µg/g weight respectively). The higher concentrations in the Residual phase of (Pb, Ni, Cu, Cd, Zn, Cd, Co, and Fe) was (55.91, 76.07, 5.36, 35.4, 50.24, 16.52, 1080) dry weight, respectively, while the lowest concentration was (25.02, 1.73, 0.27, 0.05, 2.45, 0.25, 7.22, 660) µg/g dry weight. The results showed that the concentrations of the Metals were high, except for cobalt and zinc, which were relatively few, the concentration arranged as fellow(Fe > Cd> Cu> Ni > Pb > Cr >Zn > Co). The highest value of total organic carbon concentrations (TOC %) was (0.25 µg/g) at (25-20cm) depth at the third station while the lowest value was (0.05 µg/g) at (15-10 cm) depth at the second station and the highest average value (0.18 µg/g) in the first station. Average value (0.13 µg/g) in the second area. These results showed that organic matter pollution was mainly from the direct discharge of domestic wastewater into Shatt AL- Basra. The grain size analysis was mainly silt and clay are the most predominant in the study area.

Kew word: Heavy metals, Sediment core, Shatt Al-Basrah, Pollution

Introduction:

Recently, the marine environment such as coastal areas and estuaries has been polluted with wastes resulting from human activities that contain high concentrations of nutrients, organic pollutants, trace metals, and hydrocarbons (Clark, *et al*.,2000; Kennish 2000) .Some of these chemicals are highly toxic and persistent, and these elements tend to be highly concentrated in marine food webs, once they enter this aquatic environment. The main pollution of coastal areas near major cities is due to a large number of coastal populations and the huge amounts of sewage discharged into coastal waters and anthropogenic wastes (Bothner *et al*, 2002; Bay *et al*., 2003). The addition of waste products to the environment of rivers, estuaries, and wetlands, especially those in industrial centers and populations, has greatly increased this level of pollutants, especially metals pollution (Jayaprakash, *et al*., 2005). Aquatic sediments play a major role in the geochemical and biological processes of the estuarine ecosystem. In particular, these sediments act as sinks for toxic minerals entering downstream and this sedimentary property can regulate the concentration of these minerals and compounds in the water column (de Groot *et al*., 1976). Marine sediments also play a very important role in the physical, chemical, and environmental dynamics of minerals in marine aquatic ecosystems. The physical and chemical nature

of sediment-related minerals is important in the bioaccumulation of aquatic organisms such as fish and shellfish. Accordingly, sediment quality has been recognized as an important and sensitive indicator or geographical marker of environmental pollution by many scientists.(Pekey *et al*.,2004; Ong, *et al*, 2016) . Sediments can act as an important sink for many pollutants, such as metals discharged into the environment (Tam and Wong, 2000; Bettinetti *et al*, 2003). Besides serving as an indicator of pollution, sediments are also important in the process of recharging pollutants into the aquatic environment under favorable conditions through the process of interaction between the waste column and surface sediments. (Navy,1962). The study of sediment cores over the past few decades has shown that it is an excellent tool for determining the influence of human and natural processes on sedimentation environments. At the same time, sediment cores can provide a chronology of pollutant concentrations and a record of changes in the concentration of chemical indicators in the environment. Mineral accumulation rates in sediment cores can reflect differences in mineral inputs to a particular system over long periods. Hence, the study of sediment cores provides a historical record of the different impacts on the aquatic system by both natural background levels and anthropogenic mineral accumulation over a long period of Living stone.

Material and Methods:

Descriptions of the study area:

The Shatt Al-Basrah canal of important areas is located in the Basra province in southern Iraq, next to the Zubair District, and its length is 38 km. The latitude and longitude positions of the canal ranged from E 47º 00ˈ to E 47º 60ˈ and N 30º 20ˈ to N 30º 60ˈ, respectively (Figure 1). This canal was constructed in 1983. some anthropogenic activities have been reported along the banks of the canal. It is the second-longest canal after the Shatt al-Arab River, and the first and richest waterway in Basra(AL-Mansori *et al*, 2018). It starts from the Hammar Marsh in the north and ends in Khor Al-Zubair, and the most important water sources for this canal are groundwater, water resulting from the washing operations of agricultural lands, rainwater, and river water used for irrigation projects, and tidal water (Azeez *et al*.,2006; Al-Khayat, 2007).

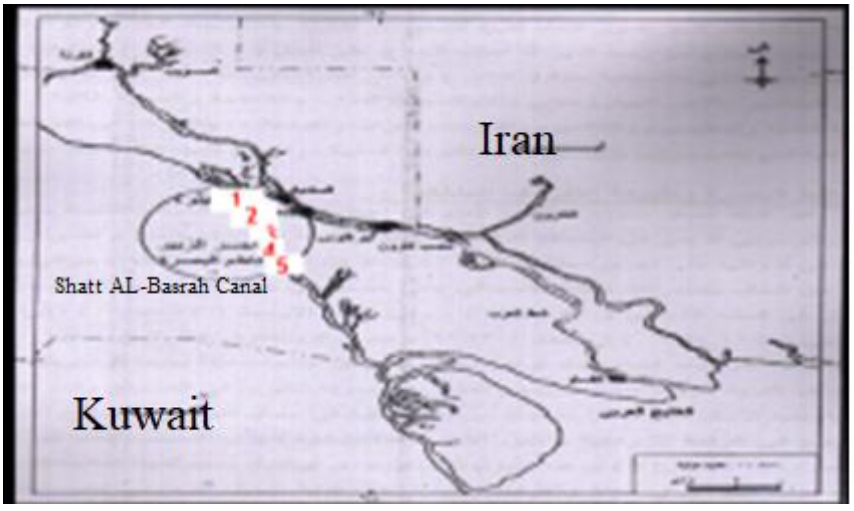

Figure 1: The study area of Shatt Al-Basrah canal

Sediment core (acid-washed PVC tubes polyvinyl chloride) 1 m long x 5 cm diameter) were collected from six stations as shown in Fig (1). The cores were inserted into the sediment-water interface and pushed to ensure that they reached maximum depth. The cores were slowly retrieved again, instantly closing in on their shell and marking any upward direction. The sediment core sample was divided into parts, each part consisting of (5 cm) Before analysis, all sediment samples were dried using a dehydrator, while the raw samples were used to determine the sediment grain size and total organic carbon. The core samples after freeze-drying were finely ground in an electric mortar and sieved through a 0.36-micron sieve. Then the ground sediments are kept in polyethylene plastic bottles until the analysis is carried out. Exchangeable heavy metal ions were extracted from the sediment according to the method (Chester and Voutsinou, 1981). 1 g of the dried sample was placed in (50 ml) of a Teflon test tube with a tight-fitting cap. Then (20 ml) of hydrochloric acid was added (0.5 normal) and shake for (16 h). Then the sample was centrifuged at (3000 rpm) for (20 min). Then, the solution was placed in a plastic (polyethylene) vial until the time of measurement by conductivity Couple Plasman (ICP) while the Residual heavy metals were extracted according to (Sturgen *et al*,1982). Concentrated hydrochloric acid (HNO3 (1:1) was added to each sample and evaporated to near dryness on a hot plate at 80 °C, then a mixture of HClO4 and HF (1:1) was added. After heating to near dryness, 20 ml of 0.5 normal HCl was added and cooled for 10 min The extract was poured into a 25 ml plastic volumetric flask This step was repeated twice and all supernatants were combined Samples were stored in sealed polyethylene bottles to be ready for analysis by (ICP). To ensure that the samples were not contaminated during work, reference samples (Blank) were made and measured when conducting the analyzes to ensure that the samples were not contaminated and the accuracy of the work.

Result and Discussion:

The results obtained from the sediment samples were high, except for Zinc and cobalt, which were relatively low. They were followed in order as follows: (Fe > Cd> Cu> Ni > Pb > Cr >Zn > Co) The high concentrations of some heavy metals in the sediments indicate that the sediments served as a sink and source for these metals.

Table (1): Concentration of Lead (µg /g) dry weight in a sediment core from the study stations.

Depth cm	Ex. Station (1)	Re Station (1)	Ex Station (2).	Re Station (2)	Ex. Station (3)	Re Station (3)	Ex. Station (4)	Re Station (4)	Ex. Station (5)	Re Station (5)
(0-5)	2.5	29.18	0.5	38.36	0.5	40.13	2.55	50.02	2.44	58.94
(5-10)	2.44	30.07	1.04	38.31	4.19	39.79	1.55	46.05	2.86	57.94
(10-15)	2.49	28.31	0.97	36.16	2.79	38.71	1.66	45.39	4.24	55.72
(15-20)	2.48	25.83	2.41	36.07	3.8	38.05	3.28	45.22	2.49	56.78
(20-25)	2.06	25.02	2.39	29.98	1.54	37.75	3.01	44.05	2.86	56.69
(25-30)	1.55	26.84	0.69	29.31	1.08	38.36	3.01	44.09	3.23	55.91
Mean	2.25	27.54	1.33	34.69	2.32	38.79	2.51	45.8	3.02	56.99

Table (2): Concentration of nickel (µg /g) dry weight in a sediment core from the study stations

Depth cm	Ex. Station(1)	Re Station(1)	Ex Station(2).	Re Station(2)	Ex. Station(3)	Re Station(3)	Ex. Station(4)	Re Station(4)	Ex. Station(5)	Re Station(5)
(0-5)	8.15	76.07	1.14	50.44	4.18	63.9	4.33	3.76	6.24	46.23
(5-10)	3.47	51.32	2.4	55.84	3.08	62.23	5.09	5.53	3.23	36.9
(10-15)	2.42	44.74	3.07	50.76	1.38	58.54	3.37	1.73	5.18	4.39
(15-20)	2.22	63.62	1.36	49.85	1.5	46.17	4.03	4.13	3.76	4.43
(20-25)	1.4	54.80	1.44	54.17	2.53	46.9	3.09	3.97	4.2	57.97
(25-30)	1.16	55.7	1.3	45.06	1.37	53.97	3.37	2.49	4.02	43.59
Mean	3.14	58.29	1.79	51.02	2.34	55.29	3.88	3.6	4.438	32.25

Table (3): Concentration of copper (µg /g) dry weight in a sediment core from the study stations

Depth cm	Ex. Station(1)	Re Station(1)	Ex Station(2)	Re Station(2)	Ex. Station(3)	Re Station(3)	Ex. Station(4)	Re Station(4)	Ex. Station(5)	Re Station(5)
(0-5)	5.53	0.66	2.18	0.64	5.27	0.52	8.03	0.91	8.25	0.44
(5-10)	5.47	0.75	3.46	0.71	5.26	0.27	11.74	1.67	7.13	2.99
(10-15)	3.52	0.64	4.51	0.6	3.34	0.4	7.07	0.52	6.29	0.35
(15-20)	2.15	1.07	2.41	0.56	3.27	0.39	27.23	2.12	5.49	0.47
(20-25)	1.97	1.16	3.25	0.7	4.03	5.36	24.22	0.83	14.16	2.09
(25-30)	1.7	1.16	3.02	0.52	15.64	0.75	17.1	0.82	15.38	0.9
Mean	3.39	0.91	3.14	0.62	6.14	1.28	15.89	1.15	9.45	1.21

Table (4): Concentration of chrome (µg /g) dry weight in a sediment core from the study stations

Depth cm	Ex. Station(1)	Re Station(1)	Ex. Station(2)	Re Station(2)	Ex. Station(3)	Re Station(3)	Ex. Station(4)	Re Station(4)	Ex. Station(5)	Re Station(5)
(0-5)	2.53	0.34	10.33	46.28	3.28	51.73	2.04	38.51	3.71	46.13
(5-10)	1.36	1.69	1.51	51.36	2.41	51.21	2.11	42.57	2.61	36.53
(10-15)	0.94	3.45	1.08	47.41	1.45	52.53	2.08	52.53	2.82	36.58
(15-20)	1.34	0.05	1.23	44.6	1.57	39.43	2.17	56.06	3.19	39.28
(20-25)	0.53	0.06	1.28	40.4	2.24	40.49	1.13	55.58	1.34	49.76
(25-30)	1.02	0.93	1.19	37.46	1.02	4.09	1.22	54.5	1.23	42.93
Mean	1.29	1.01	2.77	44.59	1.99	39.91	1.79	49.96	2.48	41.87

Table (5): Concentration of zinc (µg /g) dry weight in a sediment core from the study stations.

Depth cm	Ex. Station(1)	Re Station(1)	Ex Station(2).	Re Station(2)	Ex. Station(3)	Re Station(3)	Ex. Station(4)	Re Station(4)	Ex. Station(5)	Re Station(5)
(0-5)	1.36	26.29	0.36	23.03	2.66	28.84	4.19	23.49	5.13	2.52
(5-10)	0.49	26.03	0.54	26.47	2.37	29.87	2.37	22.08	2.09	16.6
(10-15)	0.45	25.1	1.6	25.03	1.37	30.09	2.12	25.44	1.48	17.16
(15-20)	0.38	35.4	1.21	26.46	1.53	25.81	21.01	27.92	0.47	17.13
(20-25)	0.27	32.32	3.75	27.28	0.31	36.47	35.73	24.22	16.82	27.05
(25-30)	0.3	31.1	0.53	22.92	41.15	29.84	14.65	25.44	16.39	2.45
Mean	0.54	29.37	1.33	25.19	8.23	30.15	13.35	24.77	7.06	13.82

Table (6): Concentration of cobalt (µg /g) dry weight in a sediment core from the study stations.

Depth cm	Ex. Station(1)	Re Station(1)	Ex Station(2).	Re Station(2)	Ex. Station(3)	Re Station(3)	Ex. Station(4)	Re Station(4)	Ex. Station(5)	Re Station(5)
(0-5)	0.06	7.1	0.08	7.37	0.22	0.34	0.05	7.5	0.34	6.75
(5-10)	0.08	8.56	0.06	8.51	0.79	0.49	0.44	7.24	0.05	50.24
(10-15)	0.09	7.28	0.04	8.32	0.07	0.39	0.07	6.55	0.28	6.55
(15-20)	0.06	9.87	0.05	7.21	0.05	0.32	0.2	80.01	0.05	5.66
(20-25)	0.06	10.39	0.13	8.25	0.05	0.31	0.43	8.21	0.2	14.73
(25-30)	0.02	9.38	0.04	7.13	0.04	0.25	0.4	8.43	0.2	11.15
Mean	0.06	8.76	0.07	7.79	0.2	0.35	0.27	7.66	0.19	15.85

Table (7): Concentration of cadmium (µg /g) dry weight in a sediment core from the study stations.

Depth Cm	Ex. Station(1)	Re Station(1)	Ex Station(2).	Re Station(2)	Ex. Station(3)	Re Station(3)	Ex. Station(4)	Re Station(4)	Ex. Station(5)	Re Station(5)
(0-5)	11.31	14.61	9.51	14.94	6.8	16.28	9.13	9.41	79.81	13.28
(5-10)	11.05	14.53	9.34	12.89	6.8	16.13	9.415	9.56	79.65	12.6
(10-15)	10.43	12.97	8.27	12.11	6.87	15.16	8.34	8.31	80.18	12.39
(15-20)	10.06	12.6	8.02	16.52	6.34	15.17	7.22	8.14	72.13	12.35
(20-25)	9.876	10.57	7.22	11.44	6.01	15.08	6.33	7.22	71.75	11.24
(25-30)	9.046	10.16	6.92	11.22	5.59	14.27	6.37	7.34	57.83	10.23
Mean	10.29	12.57	8.21	13.19	6.4	15.35	7.8	8.33	73.56	12.02

Table (8): Concentration of iron (µg /g) dry weight in a sediment core from the study stations.

Depth cm	Ex. Station(1)	Re Station(1)	Ex Station(2).	Re Station(2)	Ex. Station(3)	Re Station(3)	Ex. Station(4)	Re Station(4)	Ex. Station(5)	Re Station(5)
(0-5)	680.5	825	400	835	103.5	915	840.5	825	139	785
(5-10)	510.5	905	510.5	940	790	900	660.5	775	800	695
(10-15)	310	870	550	915	430.5	915	740	900	690	660
(15-20)	350.5	1080	340	860	400	720	690	920	530	695
(20-25)	230.5	900	290	915	450	970	785	860	139.5	895
(25-30)	900	915	350	845	730	880	780	885	139	785
Mean	254.44	86.79	102.6	43.7	308.62	85.42	278.42	53.42	304.92	86.7

Lead (Pb)

The study of metals in the residual phase showed that the highest concentration of lead was (it was 55.91 µg/g dry weight) at a depth of (30-25 cm) at the fifth station, while the lowest value was (25.02µg/g dry weight) at a depth of (25 -20 cm) at the first station. The average value (56.99 µg/g) in the fifth station and the lowest average value (27.54 µg/g) in the first station as shown in Table 1). While the highest concentration in the exchangeable phase of metals lead was (4.24µg/g dry weight) at a depth of (10-15 cm) in the fifth station. While the lowest value was (2.5 µg/g dry weight) at a depth of (0-5 cm) in the third station, the highest average value was (3.02 µg/g) in the fifth station and the lowest average weight (1.33µg/g) in the second station. The lowest average concentration was observed in the second station due to the few sources of pollution in this area (Table 1) The highest average concentration was observed in my fifth station due to the presence of many sources of pollution such as sewage pollutants, industrial waste, and municipal waste.

Nickel(Ni):

The study of metals in the residual phase showed that the highest concentration of nickel (it was 76.07 µg/g dry weight) at a depth (0-5 cm) in the first station, while the

lowest value was (1.73 µg/g dry weight at depth (20-25 cm) at the first station. At a depth of (15-10 cm) in the fourth station, the highest average value (58.29 µg/g) in the first station and the lowest average value (3.60 µg/g) in the fourth station as shown in (Table 2). While the highest concentration of nickel in the exchangeable phase was (8.15 µg/g dry weight) at a depth of (0-0 cm) in the first station. The lowest value was (1.16 µg/g Dry weight) at a depth of (30-25 cm) in the first station, the highest average value was (3.14 µg/g Dry weight) in the first station, and the lowest average value (1.79 µg/g Dry weight) in the second station. As shown in Table 2.

Copper (Cu):

Record of Cu metal the highest concentration in the residual phase of the copper element (5.36 µg/g Dry weight) at a depth (20-5 2 cm) in the third. While the lowest value was (0.27 µg/g Dry weight). In-depth (10-5 cm) at the third station and the highest value (1.28 µg/g Dry weight) at the third station and the average value (0.62 µg/g Dry weight) at the second station. He mainly returned to the different sources of pollution in these stations such as industrial waste discharge, oil refinery, and pollution of sewage (Table 3) while the highest concentration in the exchangeable phase of the copper element was (27.23 µg/g Dry weight) when depth (20-15 cm) at the fourth station. The lowest value (1.7 µg/g Dry weight) (25-30 cm) depth at the first average position of the value (15.89 µg/g Dry weight) at the fourth station and the lowest value (3.39 µg/g Dry weight) at the first station. This volatility in copper concentrations is shown in Table3).

Chromium (Cr):

The Cr metal study in the residual phase found that the highest concentration of chromium (56.06 µg/g dry weight) was found in the depth (20-15 cm) in the fourth station, while the lowest value (0.05 µg/g dry weight) was found. weight) (15-20 cm) the concentration was in the first station and highest (49.96 µg/g dry weight) in the fourth station and the minimum values were 1.01 µg/g dry weight (Table 4), while the higher concentration was (49.96 µg/g dry weight) dry weight) at the fourth stop. The concentration of chromium was in the exchangeable phase (10.33 µg/g dry weight) and at a depth (0-5 cm) at the second station. The lowest value (0.53 µg/g dry weight) at depth (20-25 cm) in the first station over the lowest average value (1.29 µg/g dry weight) at the first station (Table 4).

Zinc (Zn):

The Zn metal study was found in the residual phase and found the highest concentration of zinc (35.4 µg/g Dry weight) at a depth (20-15 cm) at the first station, while the lowest value was (2.45 µg/g Dry weight) 30-222 at the fifth station and average value (30.15 µg/g Dry weight) at the third station and average minimum value (13.82 µg/g Dry weight) at the fifth station as shown in (table 5). While the highest concentration of zinc was in the exchangeable phase (14.65µg / g dry weight). Feature (30-25 cm) at the fourth station. Less value (16.82 µg / gram) at the fifth station and the highest value (7.06 µg/g dry weight) at the fourth station and the lowest medium value was 0.54 µg/g Dry weight (Table 5).

Cobalt (Co):

The Co metals study found in the residual phase was found to be the highest concentration of zinc (50.24 µg/g Dry weight) (5-10 cm) depth at the fifth station, while the lowest value was (0.25µg/g Dry weight) when depth (30-25), at a third station and average station of value (15.85 µg/g Dry weight) At the fifth station because of the presence of many sources of pollution such as sewage pollutants, industrial waste, oil pollution (interpretation refinery), municipal waste and minimum value (0.35 µg/g Dry weight) Third station (Table 6) While the highest concentration of Co was in the exchangeable phase (0.79µg / g dry weight) when depth (5-10 cm) in the third station. The lowest value (0.02µg/g Dry weight) at (30-25 cm) at the first average station value

(0.27 ug / g) at the fourth station and the average value (0.06 µg/g Dry weight) at the first station. As shown in (Table 6).

Cadmium (Cd):

The Cd metal study was found in the residual phase found as the highest concentration of cadmium (16.52 µg/g Dry weight) at depth (20-15 cm) at the second station, while the lowest value was (7.22 µg/g Dry weight) at a depth (25 -20 cm) at the fourth and highest medium for value (15.35 micrograms) at the third station and average minimum value (8.33 micrograms) at the fourth station. As shown in (Table 7). While the highest concentration of cadmium was in the exchangeable phase (80.18µg / g dry weight) at depth (15-10 cm) at the fifth station. The lowest value was (9.13 µg/g Dry weight) when depth (5-0 cm) at the fourth station, the highest medium value (73.56 µg/g Dry weight) at the fifth station, and the lowest value (6.40 µg/g Dry weight). Cadmium pollution is due to increased human activities and waste without treatment.

Iron (Fe):

The Fe metal study was found in the residual phase found for the highest concentration of iron (1080 µg/g dry weight) at depth (20-15 cm) at the first station, while the lowest value was (660 µg/g dry weight) at depth (15 -20 cm) at the fifth station. The highest value of the center (86.79 µg/g dry weight) first station and the lowest medium valuable (86.7 micrograms/gram) at the Station (Table 8). While the highest concentration was in a mutual phase (900µg / g dry weight) at a depth (30-25 cm) at the first station. The less valuable (43.5 µg/g dry weight) at (25-10) depth at the third is the highest value (103.25 µg/g dry weight) at the fifth station and the average medium for value (278.42 µg/g dry weight) at the fourth stations (Table 8).

It is known that the organic matter in the aquatic environment comes from either a vital source, represented by the remains of animals, plants, bacteria, and plankton, or all of them, or through the rivers carrying agricultural and household waste, as well as what is deposited in them from the atmosphere. (Longmore and Longan, 2003) and these materials move to the bottom after being adsorbed through suspended particles to become part of the sediments. The increase in the contents of organic carbon in sediments is also due to human and animal waste. In (AL-Hejuje, 2015), the effect of chemical and biological processes that occur in sediments is significantly on the percentage of organic carbon (Balasim, 2013). The highest value of total organic carbon concentrations (TOC %) was (0.25 µg/g) at (25-20) at the third station, and the lowest value was (0.05 µg/g) at (15-10 cm) at the second station. The highest average value (0.18 µg/g) in the first and lowest station Average value (0.13 µg/g) in the second area of these results we found that organic matter pollution was mainly from a direct discharge of domestic wastewater into Shatt Basrah River Total organic carbon has a significant effect on both chemical and biological processes that occur in the sediments. As we can see in table (9).

Table (9): Concentration of Total Organic Carbon (TOC%).

depth (cm)	Station(1)	Station(2)	Station(3)	Station(4)	Station(5)
(0-5)	0.18	0.16	0.18	0.24	0.15
(5-10)	0.17	0.11	0.17	0.15	0.11
(10-15)	0.19	0.05	0.19	0.17	0.06
(15-20)	0.12	0.08	0.22	0.09	0.13
(20-25)	0.17	0.11	0.25	0.09	0.17
(25-30)	0.27	0.25	0.16	0.06	0.14
the average	0.18	0.13	0.19	0.13	0.13

It has been noted that the analysis of the Shatt al-Basra River sediments differs from one station to another according to different pollutant origins. Therefore, It can consider the sediments of the Shatt Al-Basrah canal's predominant proportion of silty clay as shown in Table (10).

Table (10): Grain Size Analysis of Sediment Core Samples in Study Stations.

Station (1)				
depth (cm)	**sand%**	**silt%**	**clay%**	**Texture**
(0-5)	**18**	**55**	**27**	**Silty clay loam**
(5-10)	**17**	**60**	**23**	**Silty loam**
(10-15)	**15**	**65**	**20**	**Silty loam**
(15-20)	**12**	**63**	**25**	**Silty loam**
(20-25)	**14**	**66**	**20**	**Silty loam**
Station (2)				
depth (cm)	**sand%**	**silt%**	**clay%**	**Texture**
(0-5)	**5**	**68**	**29**	**Silty clay loam**
(5-10)	**13**	**69**	**18**	**Silty loam**
(10-15)	**11**	**71**	**18**	**Silty loam**
(15-20)	**15**	**65**	**20**	**Silty loam**
(20-25)	**12**	**70**	**18**	**Silty loam**
Station (3)				
depth (cm)	**sand%**	**silt%**	**clay%**	**Texture**
(0-5)	**7**	**75**	**20**	**Silty loam**
(5-10)	**11**	**69**	**20**	**Silty loam**
(10-15)	**9**	**70**	**27**	**Silty clay loam**
(15-20)	**1**	**64**	**35**	**Silty clay loam**
(20-25)	**7**	**65**	**30**	**Silty clay loam**
Station (4)				
depth (cm)	**sand%**	**silt%**	**clay%**	**Texture**
(0-5)	**10**	**50**	**40**	**Silty clay**
(5-10)	**17**	**60**	**23**	**Silty loam**
(10-15)	**11**	**63**	**26**	**Silty loam**
(15-20)	**20**	**56**	**24**	**Silty loam**
(20-25)	**11**	**67**	**22**	**Silty loam**
Station (5)				
depth (cm)	**sand%**	**silt%**	**clay%**	**Texture**
(0-5)	**10**	**55**	**35**	**Silty clay loam**
(5-10)	**35**	**53**	**10**	**Silty loam**
(10-15)	**39**	**50**	**11**	**Silty loam**
(15-20)	**25**	**55**	**20**	**Silty loam**
(20-25)	**18**	**60**	**22**	**Silty loam**

Thus, the concentrations of heavy metals in these sediments of the study area in the Shatt Al-Basrah with the previously studied (Table 11). It was found that the current concentrations within most of the previous concentrations may be due to the accumulation of pollutants continuously discharged into the river without any prior treatments. It is also attributed to the absence of a withdrawal process in the Shatt al-Basrah.

Table (11): Heavy metals concentrations in total sediments (µ g/g dry weight) in the present study as compared with the other previous studies.

Studied Area	Fe	Co	Cr	Ni	Pb	Cd	Zn	Cu	Reference
Shatt Al-Arab river	6.51	-	N.D.	1.58	12.23	-		-	(Daigham 1989)
Shatt Al Arab Estuary	29.24	31.99	0.27	17.74	104.2	404.1		5210.5	(Al-Khafaji 1996)
Shatt Al-Arab river	61.3	235.4	6.39	116.6	-	-		4119.55	(Al-Saffie 2005)
Shatt Al-Arab river	5.9-81.3	24.8 - 112.4	2.0-7.8	27.6-96.2-	57.3-512.1	757.1 93.6-		4700-23700	(Al-Sabah 2007)
Shatt Al-Arab river	36.61	149.28	24.52	263.47	-	1679.26		14443.29	(Hassan 2007)
Some wetlands south of	3.21-48.69	9.15 - 539.8	2.52-35.92	26.54-543.75	95.67-486.95	3548.22 157-		148.37-18435.5	(Mahmood 2008)
Shatt Al-Arab river and Shatt	30.15	-	5.81	40.13	53.8	-		4170.33	(AlQarooni 2011)
Euphrates river	14.14	67.66	11.22	0.59	0.37	37.7		661.7	(Hassan, *et al* . (2010
Euphrates river	30.4	24.05	0.3	11.17	-	-		2034	(Al-Khafaji *et al*. 2011)
Al-Chibayish marsh	2.25	109.47	2.32	5.1	81.25	-		-	Mashkhool (2012)
Shatt Al-Arab river	26.69	75.56	-	83.78	-	528.77		1911.03	AlShmery (2013)
Shatt Al-Hilla river	8.21-21.8	-	-	18.5-27.06	114.5-140.5	-		629.0-1228.9	(Al-Robai 2013)
Shatt Al-Arab river	44.11	106.21	13.08	104.97	234.64	992.09		20485.79	Al-Hajaj(2015)
Shatt Al-Arab river	-	-	-	-	40.942-134.375	-		693.245-1159.254-	(Al- Mahana 2015)
Shatt Al-Arab river	E: 950.78-4987.92 R: 770.15-20158.26	E: 4.46-15.85 R: 8.3-18,00	E: 50.88-65.91 R: 55.11-102.87	E: 30.07-65،93 R: 50.47-85،42	E: 20.15-37،54 R: 25.61-73.19	E: 5.01-13.32 R: 6.49-15.98.	- E: 23.34-43.13 R: 44.79-65.89	E:9.17-26.49 R: 18.47 31.99-	(Al-Shamsi, 2017)
Shatt al-Basra	E:900-103.5 R:660-1080	E:0.2-0.79 R:0.25-80.08	E:0.53-10.33 R:0.05-56.06	E:1.4-38.15 R:2.49 76.07	E:0.5-4.19 R:25.02-58.94	E:5.59-80.18 R:7.22-16.52	E:0.3-41.15 R:2.45-36.47	E:1.7-27.23 R:0.4-2.99	Present study

Conclusions

The study concluded that there is an inverse ratio between the concentrations of heavy metals and the depth of some stations. The coastal area of Shatt al Basrah receives large quantities of minerals resulting from industrial waste resulting from human activity and anther sources such as Sewage pollution. If we compare our data with the previous study, we see that our data lies within some of these studies.

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توزيع ومصادر المعادن الثقيلة القابلة للتبادل والمتبقية في رواسب لبابية في قناة شط البصرة

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المستخلص:

تناولت الدراسة الحالية قياس تلوث المعادن الثقيلة في لب الرواسب في خمسه محطات مأخوذة من قناة شط البصرة ، وقد تم تحديد هذه المعادن (الرصاص والنيكل والنحاس والكروم والزنك والكوبالت والكادميوم والحديد) في الجزء المتبادل والمتبقي باستخدام جهاز (ICP). كما تم تحديد النسبة المئوية للكاربون العضوي الكلي وحجم الحبوب. أظهرت نتائج التراكيز في الجزء المتبادل(Pd،Ni، Cu، Cd، Zn، Co، Fe) أن أعلى تركيز كان (900 ,80.18 ,0.79 ,14.65 ,10.33 ,27.23 ,8.15 ,4.24) (مايكروغرام / جرام وزن جاف) على التوالي بينما كان أقل تركيز (43.5 ,9.13 ,0.02 ,16.82 ,56.06 ,1.7 ,1.16 ,2.5)(مايكرو غرام / غرام وزن جاف)على التوالي اما نتائج التركيزات في الجزء المتبقي من (P، Ni، Cu، Cd، Zn، Cd، Co، Fe) أظهرت أن أعلى تركيز كان (1080 ,16.52 ,50.24 ,35.4 ,5.36 ,76.07 ,55.91)مايكرو غرام / غرام وزن جاف) على التوالي ، بينما أقل تركيز كان (660 ,7.22 ,0.25 ,2.45 ,0.05 ,0.27 ,1.73 ,25.02)مايكرو غرام / غرام وزن جاف)أظهرت النتائج أن تراكيز المعادن كانت عالية ماعدا الكوبالت والزنك اللتين كانتا قليلة نسبيًا ، حيث تم ترتيب التركيزات على شكل التالي (Fe > Cd> Cu> Ni > Pb > Cr >Zn > Co) . مجموع تراكيز الكربون العضوي (TOC٪) كانت (0.25)(مايكرو غرام / غرام وزن جاف)عند (25-20) في المحطة الثالثة ، وأقل قيمة كانت (0.05)(مايكرو غرام / غرام وزن جاف)عند (15-10 سم) في المحطة الثانية ، و أعلى متوسط قيمة (0.18)(مايكرو غرام / غرام وزن جاف)في المحطة الأولى والأدنى متوسط القيمة (0.13)(مايكرو غرام / غرام وزن جاف)في المحطة الثانية من هذه النتائج وجدنا أن تلوث المواد العضوية كان بشكل رئيسي من التصريف المباشر لمياه الصرف المنزلية في شط البصرة . أظهر تحليل حجم الحبوب أن الطمي والطين هما الأكثر انتشارًا في منطقة الدراسة.