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Baseline

Environmental assessment of coastal surface sediments at Tarut Island, Arabian Gulf (Saudi Arabia)

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ABSTRACT

Thirty eight surface sediments samples have been collected in the area around Tarut Island, Saudi Arabian Gulf to determine the spatial distribution of metals, and to assess the magnitude of pollution. Total concentrations of Fe, Mn, As, B, Cd, Co, Cr, Cu, Hg, Mo, Pb, Se, and Zn in the sediments were measured using ICP-MS (Inductively Coupled Plasma-Mass Spectrometer). Nature of sediments and heavy metals distribution reflect marked changes in lithology, biological activities in Tarut bay. Very high arsenic concentrations were reported in all studied locations from Tarut Island. The concentrations of Mercury are generally high comparing to the reported values from the Gulf of Oman, Red Sea. The concentrations of As and Hg exceeded the wet threshold safety values (MEC, PEC) indicating possible As and Hg contamination. Dredging and land filling, sewage, and oil pollution are the most important sources of pollution in the study area.

The marginal environments appear to be an active environment with both circumstantial and temporary tendency. The main sources of land pollutions are ports harbors, shipment, power plants, pulp factories, oil and gas sills, placer deposits, sailing, and water sports centers (Pati and Patra, 2012). Heavy metals are one of the most serious pollutants in the natural environment due to their toxicity, persistence and bioaccumulation problems (Tam and Wong, 2000). The Arabian (Persian) Gulf is a shallow marginal semi-enclosed sea of the Indian Ocean (Price and Robinson, 1993). The Arabian Gulf characterized by very high evaporation rates and poor flushing characteristics (Sheppard, 1993). The average depth of the Arabian Gulf is only 36 m depth. It is characterized by the abnormal salinity. The Saudi Arabian coastline of the Arabian Gulf extends for about 450 km.

Arabian Gulf countries have witnessed major economic, social and industrial developments. The coastlines of the Arabian Gulf have been extensively developed and modified. Dredging and reclamation, industrial and sewage effluents, hypersaline water discharges from desalination plants, and oil pollution are examples of anthropogenic stresses that contribute to environmental degradation in the Arabian Gulf (Sheppard et al., 2010; Naser, 2013). The Arabian Gulf sediments consist principally of carbonates and terrigenous materials (Al-Ghadban et al., 1994; Basaham and El-Sayed, 1998; Maeda et al., 1998; Basaham, 2010). Major and trace metals enter the Gulf from both natural weathering processes and anthropogenic activities. The determination of the total metal content in the bulk sediments of coastal areas of the Arabian Gulf have been carried out in many studies (e.g. El Sayed et al., 2002; Samir et al., 2006; Basaham, 2010; Biati et al., 2012; Elhabab and Adsani, 2013; Al Kahtany et al., accepted for publication).

Tarut Island is belonging to the Eastern Province of Saudi Arabia, now connected by three causeways to Qatif. It is six kilometers from the coast; the island has an area of 70 square kilometers extending from Ra's Tannurah in the north to Qatif in the west (Fig. 1). The human and tourism activities in Tarut Island contribute to the pollution of the coastal environment. No attentions have been paid to the geochemical studies of Tarut coastal area. The present study aims to (1) analyze the heavy metals content in the surface sediment of the coastal area around Tarut Island and (2) evaluate and identify potential sources of contamination and the pollution level in the environment.

Fifty years ago, Tarut Island was considered the largest Saudi island in the Gulf region, this is no longer true. Continuous land reclamation that occurred over several decades connected the island to the city of Qatif (Fig. 2A–C). Two bridges connect the

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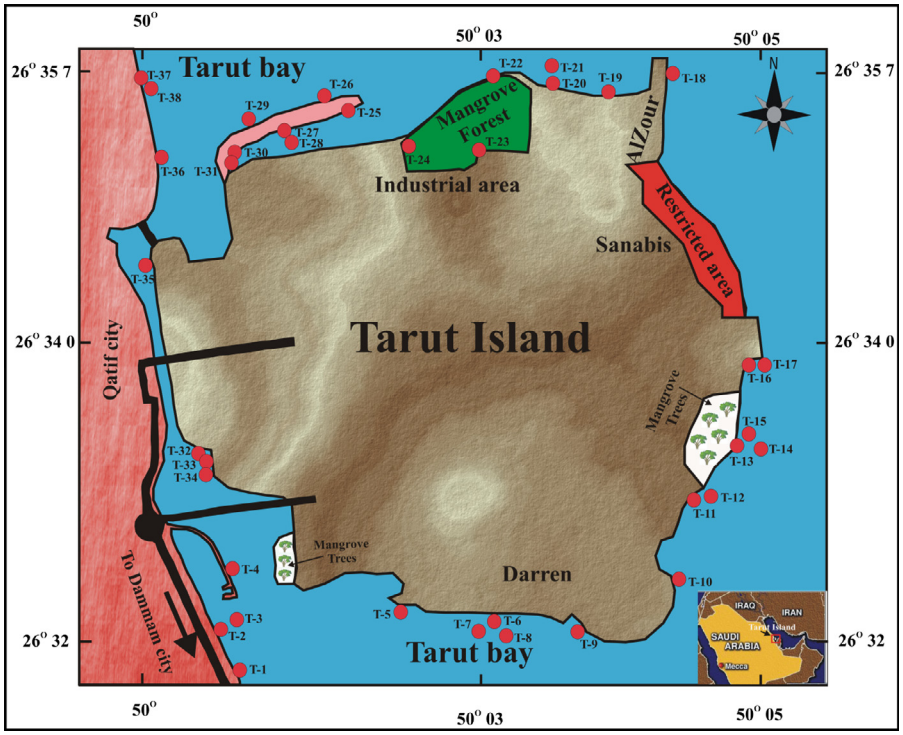

Fig. 1. Location map of Tarut Island.

Fig. 2. Different environmental hazards of study area (A–C) constructions directly on the beach, (D) the construction of the third new bridge connect the island to Qatif, (E and F) of general view of Waste dumps near the mangrove forest although the presence of sign referred to that is a protected area, (G) the oil pipeline go around the Island, and (H) fishing boats around the Island.

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