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Distribution of mercury in molluscs, seawaters and coastal sediments of Tarut Island, Arabian Gulf, Saudi Arabia

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ABSTRACT

In order to assess the distribution of mercury along the Tarut coast, Arabian Gulf, Thirty eight (38) sediment samples, twenty six (26) seawater samples, and forty (40) Mollusca specimens were collected from the Tarut coast. The concentrations of Mercury in the sediments of the studied area (average = 0.55 μg/g) are generally high comparing to the reported values from the Gulf of Oman, Red Sea, and the Gulf of Finland. The concentrations of Hg exceeded the wet threshold safety values (median effect concentration (MEC), and probable effect concentration (PEC) indicating possible Hg contamination. According to the Swedish Environmental Protection Agency (SEPA), thirty four (34) samples occur in class 4 and four (4) samples occur in class 5, which means that the sediments of the Tarut Island are largely contaminated with Hg. Enrichment factor (EF) results (average = 1.76) suggested that, the coastal sediments of the Tarut Island are considered to entirely originate from the crustal materials or natural processes. The studied sediments show lower values (Igeo<0) indicating that the sediments are unpolluted. These sediments according to contamination factor (Cf) are considered contaminated with Hg (1 < CF < 3). The Hg concentration in water samples (average = 30 μg/g) considered high. Comparison with Hg contents in coastal sediments, seawaters and molluscs in the Red Sea, the Arabian Gulf suggested that the studied samples have higher concentrations of Hg. The suggested natural sources of Hg in the study area are the weathering and decomposition of neighboring deserts. The anthropogenic sources are the land reclamation, petrochemical industries, boat exhaust emissions, oil leakage, desalination plants and sewage effluents exceeded in the study area and in Al Jubail industrial city to the north.

1. Introduction

Coastal environments are often extensively contaminated by receiving various pollutants such as toxic metals, nutrients, and pesticides (Readman et al., 1992; Bhakta and Munekage, 2010; El-Sorogy et al., 2012, 2013a, b). The major anthropogenic sources which contribute significantly to the natural background of toxic metals in soils and sediments of coastal regions are: mining and smelting, industrial sources, urban waste, waste water discharges and shipping activities.

Mercury is a volatile element emitted from both natural and anthropogenic sources (Nishimura et al., 1983). Although the atmospheric Hg input to the ocean is 2-fold higher than that from the rivers (Lantzy and Mackenzie, 1979), all the mercury moving over the surface of the globe is anthropogenic (Moore and Morre, 1976). The main species of Hg in the atmosphere is gaseous elemental Hg or Hg (0), which has a long atmospheric residence time (6–12 months) and can thus undergo long-range transport (Selin, 2009). In the atmosphere, Hg(0) can react with strong oxidants, such as halogen radicals, to form chemical species termed reactive gaseous Hg (RGM) and particulate Hg (PHg), both of which have relatively short atmospheric residence times and therefore are rapidly deposited to underlying surfaces, such as landscapes and water bodies (Steffen et al., 2008).

Many studies in the Arabian and Oman gulfs have dealt with fauna, environmental assessment, and sedimentology (Bosch et al., 1995; Sadiq and Alam, 1989; Pourang et al., 2005; Loughland et al., 2012; Naser, 2013; Almasoud et al., 2015; El-Sorogy and Youssef, 2015; El-Sorogy et al., 2016a,b; Youssef et al., 2015).

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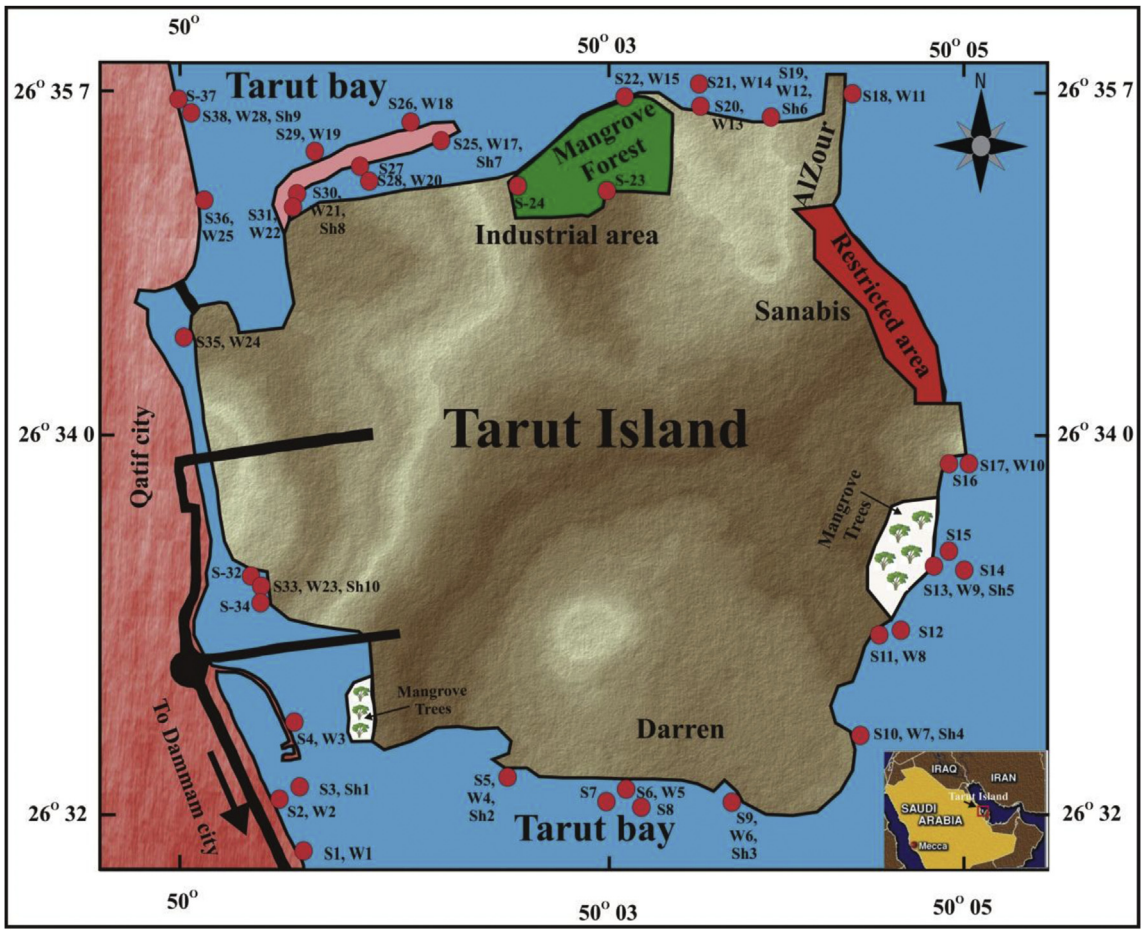

Fig. 1. Location map of the study area and the sites of the collected samples. S = sediments sample, w = water sample, sh = Mollusca sample.

The main objectives of the present study are: 1) evaluate the levels of Hg along the Tarut coast using coastal sediments, seawaters and mollusk shells, 2) assess the impact of environmental changes along the coast, 3) document the difference between gastropods and bivalves in Hg uptake, 4) comparison between the rate of pollution in the Tarut coast and neighboring coasts.

2. Material and methods

2.1. Study area

38 coastal sediments, 26 unfiltered seawaters and 40 mollusk specimens were collected in December 2014 from the subtidal zone of the Tarut Island coast (Fig. 1). Tarut is an island in the Arabian

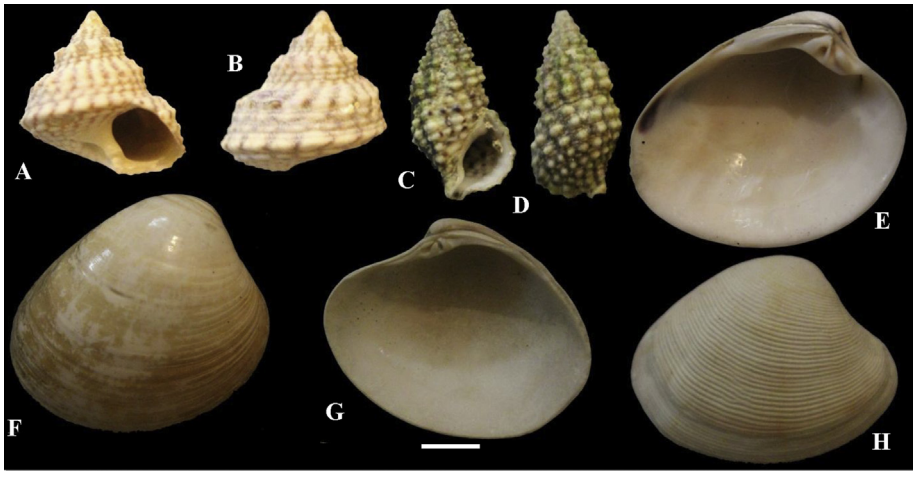

Fig. 2. A, B, *Trochus (Infundibulops) erithreus*; C, D, *Clypeomorus bifasciatus persicus*; E, F, *Amiantis umbonella*; G, H, *Protapes sinuosa*.