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Sea level changes in northern part of the Persian Gulf during Holocene

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Abstract

The Persian Gulf is a sedimentary epicontinental and marginal basin located in a dry climate. The climate, morphology, hydrology, current, waves and tide specifications determine its sediments' types. To study the paleoceanography of the Persian Gulf, a core having the length of 15m from shallow water close to the coastal areas of Bushehr in form of an undisturbed sample was prepared. After cutting the sample, macroscopic verifications, photography, and description of cores, 50 subsamples were prepared and granulometry and ICP analyses implemented. Results obtained by granulometry and percentage of particles, plus outcomes of chemical analysis and microscopic observations indicate that there is a positive correlation between calcium value and particle sizes. It means when Ca value increases, the percentage of sand also increases. In comparison with sedimentary facies, Ca value is similar to coastal and continental facies. When facies are marine, particle sizes decrease, but the values of Al, Mg, Na and K increase. In fact, rising of the Sea level is along with decrement of particle sizes, and increment of clay minerals, like Al, Si, K & Mg. But Ca value is increased by decrement of sea water level and increment of particle sizes. Therefore, when seawater level is high, the minimum of Sea level conditions occurred in 204, 396, 516 and 673 centimeters from the surface. The Maximum of Sea levels has been seen in 280, 510,593 and from 714 to 140 centimeters below the surface.

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Keywords: Sea Level Change; Holocene; Persian Gulf; Core; paleogeography.

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1. Introduction

The Persian Gulf is a back arc basin and marginal sea, and its average depth is about 35m. Its area is about 226000sqkm having the maximum depth of 104m (Purser, 1976). The Persian Gulf floor is unstable from tectonics point of view and has a sharp slope on the Iranian side. It is stable in the Arabian shield, has a mild slope and does not have continental shelf. In the northern part, its source of fresh water is Shatt-ol-Arab or Arvand Rood (originating from the Tigris and Euphrates Rivers in Iraq) and certain small rivers along the Iranian coasts. The arid climate of this region is intensively impressed by oceanographic and sedimentary processes of the Persian Gulf (Emery, 1956; Pilky and Noble, 1966; Khalaf et al., 1979; Evans, 1988). A surficial current produced an oceanic water entry cycle clockwise along the Iranian coastline (Hartman et al., 1971). Water salinity varies from 36.6% at the beginning point of the Hormoz Strait to 40.6% at the end part in the northwestern area (Swift & Bower 2006).

The recent sediments of the Persian Gulf are riverine clastic, biogenic and aeolian deposits (Lak, 2010). Riverine clastic deposits originate from Shatt-ol-Arab certain small rivers of the northern coats. Arvand flooding has a small role in sediment supply because most of them are trapped in the delta area, and only a small amount of them (about 10%) reaches the Persian Gulf (Emery, 1956; Milliman and Meade, 1983; Al-Bakri and El-Sayed, 1991). Aeolian deposits mainly originate from southwestern winds (Purser, 1973; Evan, 1988). Dusty storms bring relatively high amount of fine-grain clastic materials from coastal plains, northern deserts, northwestern part (Iraq) and Arabian deserts to the Persian Gulf (Sugden, 1963; Khalaf et al., 1979; Al-Bakri et al., 1984).

Fig. 1. Location of the Bushehr core, shallow water of the Persian Gulf.

This region located between the Zagros Mountains in northeast and Arabian Platform in the southwest having a 990km length and 370km width (Kampf & Sadrinasab 2006). After the Gulf of Mexico and the Hudson Bay, the Persian Gulf is the third biggest gulf in the world. This gulf connects the Hormoz Strait and Oman Sea to the Arabian Sea in the east. It also ends in the Arvand Rood Delta that is the result of merging of the Tigris, Euphrates and Karoon Rivers. Since plenty of relatively comprehensive environment and organic geochemistry studies of Holocene sediments were carried out by various scientists, such as Kirkham, 1997; Al-Ghadban et al., 1996 & 1998; Whittle et al., 1998 & Al-Sharhan and Kendel, 2003), therefore, it seems compulsory to implement studies respecting these subjects in northern coasts (Iranian part) of the Persian Gulf. The study area located in shallow water close to the coastal areas of Bushehr city north of the Persian Gulf (fig. 1).

2. Methodology

In this research, an undisturbed core having a length of 15m and 5 diameter was prepared by drilling device. 23 cores having 60cm dimensions were prepared in polika (PVC) pipes, after numbering and marking the upper part of layers, two ends of samples were protected and transferred to marine geology laboratory of applied geology research center in Karaj. Cores were longitudinally cut to two parts by core-cutting device. The facies characteristics, such as sediments' grain sizes, color, fossils' contents, organic matters and their contact were severely considered, and possibly sedimentary environment of each facies was determined. Cores' photos were taken by a Canon 12 megapixel digital camera. Then, 1cm slabs of some parts of core that did not have coarse grains were prepared. X-ray images of slabs were provided by radiography device. 50 sub-samples were produced from cores (figure 2).