Study of Sedimentology of Status in Caspian Sea Coast, between Ramsar and Rudsar

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ABSTRACT

The south coast of the Caspian Sea which is located in the hillside of the Alborz Mountains, does not have any natural pathway to any ocean so the Caspian sea’s water-level is always changing and it can be the reason for having specific sedimentary trades in this location. This research compares two different studies. The first groups samples have been gathered from the 5 research stations near the coastal line while the second one inspecting the samples from the depth of 5 meters. Studying these samples in the matters of sedimentary size and gradation, show that sedimentations with the same size of sand and silt take the highest place. The important point is that the average of coastal grain size is the same with the sand ones, on the other hand, for the collected samples from the depth of 5 meters it would be the same size of silts. There is a small amount of gravel and in fact there are no records of clays. It is clear that sorting in deep sedimentary is better than coastal ones. By studying mineralogy, it appears that Quartz, Calcite and Feldspars are the main minerals which form the coastal sedimentary.

Key words: Caspian Sea, Alborz Mountains, Hillside, Sedimentations, Silts, Gravel, Quartz, Calcite

Introduction

The aim behind the study of sediments of Caspian Sea Shore is study of the sediments texture, Mineralogy composition and sedimentary minerals. The study of the sediments texture and statistical indexes (such as size, shape, sphericity, sorting, strain and tilt) provides some useful information about the transportation process of sediments, disposition process, energy of dispositional environment, rock mother specification and evaporation process[15]. Through the study of mineralogy composition of sediments, the climate, the material of sediments rock mother, the of digenetic process, the situation of sedimentary environment, disposition process and the environment energy are defined [2]. The zone under study includes 10 stations through the coast and 5 meter deep Caspian Sea from Rodsar province to Ramsar province. Due to the variable area in this Sea based on the continuity of the changes, shores are gently sloped [13]. It is important to mention that stations S1, S4, S5, S7, and S10 are for coastal samples while stations S2, S3, S6, S8 and S9 are for sampling from 5-meter depth.

Methods:

In this study, appropriate sieves are used for gradation of grades bigger than 0.075 mm while for the ones smaller than 0.075 mm a standardized hydrometer is needed. Then the diagrams of normal distribution and cumulative percentage of each station are drawn also related statistical indexes including median, mean, sorting and skewers are calculated [3]. In order to study and defining the sediments mineralogy composition, passive X-ray distribution (XRD) is applied. Based on complementary studies, the level of dissolved oxygen in water and its acidity are measured. To determine the amount of calcareous materials, the method of the effect of hydrochloric acid on sediments and defining the dissolved part by acid is used [9].

Results of studies:

The particle size of bed surface sediments of river and coastal line of Caspian Sea varies from few microns to few centimeters. The study over gradation of sediments shows that there are various types from particles smaller than 63 microns which are mostly Silty and clayey particles to bigger ones like sands and gravels which include Clastic particles such as quartz, Clastic calcite, Orthoclase and also rarely
biochemical particles like bivalves, Foraminifera and Ostracodas are found [7]. Based on the result of particle aggregation and constituent weight percentage, sediments of the zone under study (Coasts from Rudsar to Ramsar) are studied based on Folk triangular diagrams [6].

![Map showing the location of sampling stations Caspian Sea Coast, between Ramsar and Rudsar, Iran](image)

The size of particles and the distribution of surface sediments in seas and rivers’ bed are of great importance as they reflect the energy level of sedimentary environment and they are considered crucial factors to control the environment [11]. So that Benthonic are the most abundant among the sediments with size of small sand to average size. In the studied zone, the coastal plain doesn’t extend much because the distance between the zone and the highlands is little and therefore rivers sequestrate big particles in size of Pebble and cable over the shoreline of the zone, that’s why in some parts of it, pebbly shore is seen.

The main minerals among samples under study are quartz, calcite and feldspar. Based on the minerals, the particles’ diameter in the area of sand, silty sand, silt and sandy silt is determined among surface sediments of the shoreline of Caspian Sea bed in the studied zone. It is important to mention that sedimentology statistical indexes such as sorting, skewers, median, mean and strain also type of sediments were calculated separately by Sediment Size Software for all sediments samples[14](Table 1).

<table>
<thead>
<tr>
<th>Samp No.</th>
<th>Clay (%)</th>
<th>Silt (%)</th>
<th>Sand (%)</th>
<th>Gravel (%)</th>
<th>Sediments Type</th>
<th>Mz</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>0</td>
<td>5.159</td>
<td>94.63</td>
<td>0.209</td>
<td>Sand</td>
<td>2.4</td>
<td>2.29</td>
</tr>
<tr>
<td>S2</td>
<td>0</td>
<td>99.78</td>
<td>0.21</td>
<td>0</td>
<td>Silt</td>
<td>3.99</td>
<td>3.99</td>
</tr>
<tr>
<td>S3</td>
<td>0</td>
<td>98.82</td>
<td>1.18</td>
<td>0</td>
<td>Silt</td>
<td>3.99</td>
<td>3.99</td>
</tr>
<tr>
<td>S4</td>
<td>0</td>
<td>21.54</td>
<td>78.45</td>
<td>0</td>
<td>Silty sand</td>
<td>2.69</td>
<td>2.73</td>
</tr>
<tr>
<td>S5</td>
<td>0</td>
<td>26.65</td>
<td>73.94</td>
<td>0</td>
<td>Silty sand</td>
<td>2.77</td>
<td>2.59</td>
</tr>
<tr>
<td>S6</td>
<td>0</td>
<td>9.58</td>
<td>90.41</td>
<td>0</td>
<td>Sand</td>
<td>2.96</td>
<td>2.96</td>
</tr>
<tr>
<td>S7</td>
<td>0</td>
<td>1.004</td>
<td>98.75</td>
<td>0.24</td>
<td>Sand</td>
<td>2.1</td>
<td>2.07</td>
</tr>
<tr>
<td>S8</td>
<td>0</td>
<td>39.62</td>
<td>40.37</td>
<td>0</td>
<td>Sandy silt</td>
<td>3.59</td>
<td>3.66</td>
</tr>
<tr>
<td>S9</td>
<td>0</td>
<td>83.39</td>
<td>16.35</td>
<td>0.24</td>
<td>Sandy silt</td>
<td>3.89</td>
<td>3.9</td>
</tr>
<tr>
<td>S10</td>
<td>0</td>
<td>9.83</td>
<td>89.82</td>
<td>0.34</td>
<td>Silty sand</td>
<td>2.76</td>
<td>2.84</td>
</tr>
</tbody>
</table>

Mineralogy studies:

The mineralogy composition of samples is defined using XRD approach [1]. The result reveals that Quarts, Calcite and Feldspar are major minerals while Hematite and Augite are secondary ones (Table 2).

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
</tr>
</tbody>
</table>

Table 1: Changes of Statistical indexes’ in the sediments of stations under study.

Table 2: Abundance of minerals in studied stations
The sedimentary environment:

Advanced sedimentology studies based on distribution maps of surface sediments and sedimentary indexes such as particle size, sorting and etc. it is possible to distinguish different types of sedimentary environment also to define erosion or with no sediments, sorting, second transportation, depositional and sedimentary environments [11]. Antropozhenic and human activities besides rarely marine hurricane are among the most important factors affecting current sedimentary environment also Caspian Sea sediments in a large scale [12].

River environment:

Rivers are the major factors of supplying sediments in coastal and marine environments besides they affect the morphology of coasts through coastal sediments transportation [4]. In the coasts of studied zone there are a number of big and small rivers which transfer the drainage of Alborz mountain range into Caspian Sea. Among all, the most important ones are Ramsar, Rodsar and Chaboksar rivers and several small floodways [8]. (Fig 2, 3)

Fig. 2: Opening of Ramsar River to Caspian Sea

Fig. 3: Opening of Chaboksar River to Caspian Sea

Coastal environment:

The main factors affecting the Caspian Sea coasts in the studied area are rivers, waves and long shore currents. Rivers are the first affecting factor on sedimentation process over the zone coast (Rubble beach) due to the presence of Pebbly and cable coarse particles [10]. On the other hand because in the coasts affected by waves or long shore currents, coastal sediments are usually in size of sand and there is a fine sorting [5] while in the studied zone it is not true. It is to be mentioned that these waves and currents move small clay particles which leads to massive gathering of sand particles in the zone while they are not strong enough to move Pebbly and cable particles. Also it is important to know that a part of Pebbly and Cable coarse particles existing in the coast are in fact shell pieces (mainly….) which
although are big in size, due to less weight they get transferred from the sea to the coast by waves and currents and also are sequestrated[14]. Therefore, there are Pebbly clastic shore (Affected by the river, Fig.4) and Pebbly biochemical shore (Affected by waves and parallel current of the coast, Fig.5) in the studied zone.

Fig. 4: Pebbly clastic shore, Kalachai shore (Sampling location, station S5)

Fig. 5: Pebbly biochemical shore, Chaboksar shore (Sampling location, station S7)

Conclusion:

The size of particles, distribution model of coastal sediments in rivers and seas’ bed are of great importance as they simply reflect the energy level of sedimentary environment and also control the environment [11]. In a way that among the sediments with sand size from small to average, Benthonic are mostly abundant [16]. In the studied zone, because of the little distance between the coast and highland, coastal plain is not very extended and rivers sequestrate big particles in size of pebbly and Cable in the shoreline of the zone, this fact leads to existence of pebbly coasts in some parts of the zone.

The main minerals of the studied zone are quarts, calcite and feldspar. It is to be mentioned that Halite also was seen, which is probably the result of dissolved salt of the sea water left after the sample dried up in the analysis while the sedimentary situation doesn’t exist in this zone to form this evaporation mineral.

On the other hand the mineralogy study by XRD approach (buffer approach) shows that the main clay minerals of sediments is chlorite, besides other minerals such as Mika, Illite, Montmorillonite are shown as secondary clay minerals in some samples[1]. Chlorite, Mika, Illite minerals are the most important clay ones which enter Caspian Sea due to the erosion of Alborz mountain range.

The environmental situation (little distance to highlands and lack of a vast coastal plain) also mild to cold climate of southern coasts of Caspian Sea (studied zone) because the chlorite and Illite be the main clay minerals in Caspian Sea sediments of sampling zone.

References