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Depositional cycles and Fe/Mn ratio in Upper Absheron substage succession in the western flank of the South Khazarian/Caspian depression of the Azerbaijan Republic

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The Caspian Sea, the largest land locked basin in the world, isolated from ParaTethys at the end of Messinian. Since that time sedimentation there took place under conditions of isolated basin temporarily connected with Black Sea in Upper Pliocene (Akchagyl). For the first time very detailed study (centimeter scale) of outcrop was carried out for stratigraphy and paleoecology of the Upper absheron substage deposits cropped out in the Western flank of the South Caspian depression (Shikhovo exposure) of the Azerbaijan Republic. The data obtained demonstrated the high-frequency cyclicity in sedimentation accompanied by rapid lateral and vertical depositional environment change. Most of these system tracts have not yet been studied in detail. The depositional setting during accumulation of this succession has changed within shore face-shelf environment. On the background of these cycles, the depositional series of a higher order containing sediments deposited during very small-scale sea level fall and rise occur. Some information contained in this document is the new data, due to more recent observations and interpretations.

The results of the field works on exposures of the Eopleistocene deposits exposed in the Western flank of the South Caspian depression (Shikhovo outcrop) demonstrated the high-frequency cyclicity in sedimentation. It is possible to observe several full depositional sequences developed from transgressive system tract to low stand system tract, to high stand system tract and return to sedimentation under conditions of sea level rise. The studied successions are characterized by steep foresets, about 12º, which is evidence of steep slope existed during the sediment accumulation.

On the background of above mentioned cycles, the depositional series of a higher order containing sediments formed during very small-scale sea level fall and rise occur. Below we give the lithofacial characteristics of one full depositional cycle and our interpretation of depositional environment during its sedimentation.

Bedset I (a) is subdivided into 10 interbeds with total thickness 3m 82 cm. Lithologically represented by alternation of shelly sandstone, sandstone, sandy silt, sandy organogenic limestone, and sandy shales. We consider this series as transgressive system tract.

Bedset I (b) is subdivided into 8 interbeds with total thickness 2m 98 cm. Lithologically represented by alternation of sandy silt, sandy organogenic limestone, shelly sandstone and sandy shales. We consider this series as transgressive system tract. In this bedset the measurement of Fe/Mn ratio was made only from 4 interbeds: Fe/Mn= 16,1 (Interbed 2); Fe/Mn = 27,8 (Interbed 4); Fe/Mn = 4,2 (Interbed 6); Fe/Mn = 15,8 (Interbed 8).

Bedset I (c) is startigraphically younger portion of the same unit and displays lateral facial replacement of proximal, possible, shore face setting by distal shelf environment. Bedset consists of 22 interbeds with total thickness 1m 78 cm. Lithologically represented by alternation of sandy silts and sandstones with two interlayers of sandy limestones. Angle of dipping varies from 9º to 11º. We consider this series as transgressive system tract. In this bedset the measurement of Fe/Mn ratio was made from 19 interbeds: Fe/Mn = 17,6 (Interbed 2); Fe/Mn = 52,6 (Interbed 4); Fe/Mn = 8 (Interbed 5); Fe/Mn = 6,8 (Interbed 6); Fe/Mn = 41,3 (Interbed 7); Fe/Mn = 75,1 (Interbed 8); Fe/Mn = 22,2 (Interbed 9); Fe/Mn = 32,7 (Interbed 10); Fe/Mn = 24,4 (Interbed 11); Fe/Mn = 44,6 (Interbed 13); Fe/Mn = 12,8 (Interbed 14); Fe/Mn = 4,3 (Interbed 15); Fe/Mn = 7,6 (Interbed 16); Fe/Mn = 18,6 (Interbed 17); Fe/Mn = 59,8 (Interbed 18); Fe/Mn = 51,1 (Interbed 19); Fe/Mn = 29,1 (Interbed 20); Fe/Mn = 12,3 (Interbed 21); Fe/Mn = 48,5 (Interbed 22).

Bedset II is the massive and homogeneous, thickness 80cm. Lithologically represented by organogenic limestones. Thickness of the bedset increases along striking from 22cm to 85cm. Bedset II lies with angular unconformity (10º) on the bedset I. We think, that this depositional series was formed during sea level drop- low stand system tract.

Bedset III subdivided into 5 interbeds. Total thickness - is 31cm. Llithologically represented by alternation of sandy silts with one sandy shale lamina and shelly sandstones. Thickness of the bedset increases along striking from 10cm to 54cm. Bedset III overlies with angular unconformity (11º) on the bedset II. We consider that bedset III represents the rapid very short sea level rise on the background of its general fall. In this bedset the measurement of Fe/Mn ratio was made only from 3 interbeds: Fe/Mn = 26,9 (Interbed 1); Fe/Mn = 148,6 (Interbed 3); Fe/Mn = 57,4 (Interbed 5).
Bedset IV is massive and homogeneous and composed of organogenic limestones, the thickness is 90cm. Thickness of the bedset increases along striking from 30cm to 1m. Bedset IV lies with angular unconformity (15º) on the bedset III. We consider the Bedset IV as low stand system tract.
Bedset V represented by sandy shale, the thickness is 10cm. Bedset V lies with angular unconformity on the bedset IV. Dipping angle varies within limits 14º. We think that Bedset V was formed during sea level high stand and represents high stand system tract. In this bedset the measurement of Fe/Mn ratio was made only from 1 interbed: Fe/Mn= 96,8 (Interbed 1).
Bedset VI subdivided into 6 interbeds with total thickness 1m 49cm. Bedset lithologically represented by alternation of sandy organogenic limestones, sandy silts and shelly sandstones. Thickness of the bedset decreases along striking from 1m 70cm to 95cm. Bedset V lies with angular unconformity on the bedset IV. Dipping angle varies within limits 14º - 16º. We think that Bedset V was formed during sea level rise and represents transgressive system tract. In this bedset the measurement of Fe/Mn ratio was made only from 2 interbeds: Fe/Mn = 24,7 (Interbed 2); Fe/Mn = 29,6 (Interbed 4).
Bedset VII subdivided into 12 interbeds. Total thickness - is 1m 57cm. Bedset lithologically represented by alternation of the sandy shales, sandstones, muddy sandstones, sandy silts and in a lesser degree- sandy limestones and shelly sandstones. Bedset VII lies with angular unconformity on the bedset VI. Thickness of the bedset increases along striking from 1m 3cm to 3m 40cm. Angle of dipping is much smoother- 4º-6º. Bedset VII is the high stand system tract. We consider this series as transgressive system tract. In this bedset the measurement of Fe/Mn ratio was made only from 4 interbeds: Fe/Mn = 19,3 (Interbed 1); Fe/Mn = 30,1 (Interbed 3); Fe/Mn = 12,1 (Interbed 8); Fe/Mn = 12,4 (Interbed 11).
The faunal analysis displays an insignificant presence of mollusk fauna mainly represented by Cardiidae and Dreissensia and mostly developed in the organogenic limestones. However our studies demonstrated the abundance of Ostracoda shells represented by genera Tracheleberis, Loxoconcha, Leptocythere, Xestoleberis, Candona, Caspiocypris, Mediocytherideis, Caspiella, Cyprideis, Cyprinotus and e.t.c. The quantitative changes of ostracoda composition for each interbed depending on paleosalinity fluctuations, in detail point out to the tendency of increasing and decreasing of Fe/Mn ratio in shells as indicator of paleosalinity. It was clearly recognized that Fe/Mn ratio increases in transgressive system tract and reduces in high stand systems tracts. As well as was observed positive correlation tendency between amount of ostracoda shells and Fe/Mn ratio, in most cases with increasing of Fe/Mn ratio, amount of ostarcoda shells increases and with decreasing of Fe/Mn ratio, amount of ostracoda shells reduces. Just in some cases we can observe invert correlation, for example at bedset V, which is the transgressive system tract. Carried out biogeochemical analyses also have shown, that amount of the studied elements, including Fe and Mn considerably varies in a section, which reflects the change in depositional setting during accumulation of sediments.