Sequence stratigraphic analysis of the Galmaz field based on well logging data

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Abstract. It is known that over 90% of oil, gas and gas condensate in Azerbaijan is produced from Productive Series (PS) of the Early Pliocene. In this respect, the detailed study of Productive Series deposits and their evolution conditions has a special value. Currently in most sedimentary basins of the world the latest highly informative methods of stratigraphic analysis are applied and one of these methods is sequence-stratigraphy, which is used in this study. The application of the concept of sequence stratigraphy enables an in-depth analysis of the study area to be conducted from a geological point of view. Despite the fact that the search for oil and gas deposits in the basins of Azerbaijan Republic has been going on for many years, there is a limited understanding of the distribution of elements associated with the oil system within the sequence stratigraphic structure. This is evidenced by the small number of scientific publications that exist in this area at the moment. To study in more detail the sedimentation process of PS of the Pliocene in the Galmaz field the genetically tied facies have been outlined and correlated within the framework of chronostratigraphic boundaries. As the study targets we have chosen the stages of Absheron, Akchagyl and PS of Pliocene in the Galmaz field. New data acquired by well logging techniques were re-examined in detail. To analyze and interpret the data, Neuralog™ and Petrel™ software were applied. From positions of the sequence-stratigraphy and taking into account the curve features (gamma ray log) predictions of the sedimentation environment of PS have been made. In the study process the sequences and system tracts have been outlined and studied, the sedimentation periods of the outlined sequences have been defined. It has been suggested to apply stratigraphic surfaces for tracing changes in regression and transgression surfaces. Clay and sand fractions of rocks were evaluated with further lithological analysis. On the gamma-ray curves, the intervals with intensity values less than 3.5 mR/h were considered as reservoir layers. At the same time, the normalized value of αSP, calculated from the curve of Spontaneous Polarization, was assumed to be greater than 0.6. Based on the sequence-stratigraphy analysis of oil-field geophysical data it has been established that the geological section of the Galmaz area was developing at various rates and in frequently changing energy mode. It has also been made clear that parasequences of the Absheron stage and Productive Series were formed in progradation mode by detritus brought by river flows. Akchagyl sediments play the role of the regional major cap in the basin.

Keywords: sequence stratigraphy, well, boundaries, regression, transgression, system tract.
Introduction

Detailed study of the setting of Productive Series and the conditions of its evolution have both theoretical and practical value as over 90% of oil, gas and gas condensate produced in Azerbaijan are extracted from this series. For the last few years in many sedimentary basins around the world the latest, highly informative methods of analysis, including the sequence-stratigraphy method have been applied.

The sequence-stratigraphy method allows us to fulfill more accurate chronostratigraphic division of logging diagrams applied for identification of possible oil and gas saturated horizons in the range of sequences and outline stratigraphic traps. The units of sequence-stratigraphic analysis reflect the cyclicity stipulated by relative changes in sea level by selection of sequences and sedimentary tracts. This allows us to predict allocation of facies and simplifies the detailed correlation and mapping of these sediments.

Literature review

A large number of papers has been devoted to historic review and description of the sequence-stratigraphy method (Catuneanu, 2017; Catuneanu et al., 2009; Catuneanu et al., 2011; Embry and Johannesen, 2017; Kendall, 2014; Van Wagoner, 1990). These works consider the basic principles of sequence-stratigraphy, give the definition of the sequence and describe the types of sequences and system tracts.

At the same time during recent years new approaches to the use of the sequence-stratigraphy method have been proposed by many researchers (Abd Al-Salam Al-Masgari et al., 2021; Ainsworth, 2010; Miller et al., 2018; Nwaezeapu et al., 2018; Okpikoro and Olorunniwo, 2010; Zhu et al., 2013). In the work by Abd Al-Salam Al-Masgari et al., sequence-stratigraphic research was carried out mainly on the basis of seismic data. Well logging data were applied only for outlining of boundaries of the sequences. The aim of this work was to identify the seismo-facies, boundaries of the sequences and system tracts. As a result of seismo-facies analysis the authors outlined and described the dominating seismic facies, which were interpreted as a possible reservoir for accumulation of hydrocarbons (Abd Al-Salam Al-Masgari et al., 2021).

Miller et al. have shown in the case of Miocene and Middle Cretaceous sediments of New Jersey paleoshelf that cessation of reflections is the physical criterion of sequence boundaries and respective breaks, which are confirmed by core data and logging diagrams (Miller et al., 2018).

The work of Ainsworth considers the influence of impermeable fractures on connections between reservoirs by use of 3D modeling of a reservoir based on the sequence-stratigraphy method (Ainsworth, 2010).

One more new sequence-stratigraphy approach was suggested by Nwaezeapu et al. According to this approach, the high-resolution biostratigraphy, analysis of logging diagrams and interpretation of seismic data are three major components making up the sequence-stratigraphy. All these data were analyzed and combined in order to decrease the uncertainty during correlation and mapping of sequences and system tracts (Nwaezeapu et al., 2018).

In the paper by the authors Okpikoro and Olorunniwo, the concept of sequence-stratigraphy by use of seismic data and well logging data were used for mapping of stratigraphic traps with the aim of reconsidering the most promising areas and increase of production (Okpikoro and Olorunniwo, 2010).

The relations between accumulation of sediments and stratigraphic evolution in an intra-cratonic basin were studied by Zhu et al. The understanding of these relationships is required for interpretation of sequence-stratigraphic structure, as well as for prediction of allocation of possible sandy rocks-reservoirs in such basins.

It is known that prediction of oil and gas is mainly based on facies analysis of environments where rocks are forming. In this respect, work on reconstruction of the sedimentation environment of Productive Series by use of sequence-stratigraphy is very important.
The research presented here is aimed at clarifying the environment of sedimentation and study of the characteristics of lithological-facies of the Absheron, Akchagyl stages and Productive Series of Pliocene in the Galmaz area by use of well logging data and based on the concept of sequence-stratigraphy.

The study target

As the study target, we consider the Galmaz field located in the north-eastern part of the Low Kur trough. In the east, the field borders Pirsaat, in the south it borders Kursyanga and in the north-west the Mishovdagh folds.

The geological setting of the region has been studied by use of geological methods since 1913. In 1955-1956 the drilling of structural-mapping wells down to a depth of 1200 m in the arc belt of the fold identified the presence of two anticlinal folds consisting of Absheron and Baku stages. These works recovered layers of oil and gas bearing sand and sandstones in the lower and middle parts of Absheron stage. This triggered work on drilling deep exploration wells in the Galmaz area, which started in 1956.

Drilling recovered sediments of Productive Series of Pliocene, Akchagyl, Absheron and Khazar stages. The section of Akchagyl and Absheron stages and the upper horizons of Productive Series are featured by high sand presence.

The Productive Series (Lower Pliocene) sediments are outcropped in the hills of Alyat Ridge in the north of the field. According to the surface and well data, the alternation of sandy-clay aleurolite layers is characteristic here. The geological section of Productive Series in the Galmaz area is represented by more than 20 sandy horizons with various reservoir properties.

In the upper part of the Productive Series the I-XX horizons were outlined. Below horizon XX the horizons of the lower part of the Productive Series are identified and they are represented predominantly by clay.

In the upper part of the Productive Series four productive horizons made of highly sandy aleurolite rocks have been outlined. Of these, the horizons I and IV have higher hydrocarbon presence that the other horizons.

The Akchagyl stage (Upper Pliocene) is made of grey sandy-clay aleurolite and dark-grey clay. The upper part of the section is with higher sand content in comparison to the lower part. In the middle part of section more clay layers are observed. In the lower part, aleurolite plates are observed.

Absheron stage (Quaternary) is divided into the lower, middle and upper sub-stages. Lithology is represented by sand and snaidstone with dominance of clay.

The upper part of the Quaternary consists of components of various continental genetic types (alluvial-proluvial, proluvial-deluvial, etc.), ancient Caspian sediments and mud volcano breccia.

Material and methods

Increasing rates of drilling of oil and gas bearing structures of anticline type are leading to their gradual depletion. Under these conditions, the search for oil and gas in non-anticline traps, which are an unused reservoir of hydrocarbon raw materials, is becoming increasingly important. In this regard, modern methods of stratigraphic analysis are used in many sedimentary basins of the world. These methods include also the method of sequence stratigraphy.

The research subject was the sediments of Absheron (Q,ab), Akchagyl (N2,ak) stages and Productive Series of Pliocene (N1,b) in Galmaz area.

Based on the latest achievements of sequence-stratigraphy, we have suggested an efficient approach to the study of sections of the Galmaz field by use of the known stratigraphic surfaces. These studies are based on selection and analysis of stratigraphic surfaces, sequence boundaries and system tracts. The study of relative variation of the level and rocks deposited at various time periods, from the point of view of geology, is possible on the basis of boundaries, which are applied in sequence-stratigraphy (Catuneanu, 2017; Catuneanu et al., 2009; Embry and Johannessen, 2017; Kendall, 2014).

It must be noted that in the present paper, the sequences and sedimentary system tracts have been outlined and analyzed, and in addition, the shapes of anomalies on GR curves corresponding to each sequence have been studied in detail. Based on this analysis, the sedimentation process has been described. At the same time, we studied the reservoir properties with further lithological analysis.

This paper uses three major surfaces: the sequence boundary (SB), transgression surface (TS) and the surface of maximum flooding (mfs) (Catuneanu, 2017; Van Wagoner et al., 1990).

SB is the boundary of the sequence, which emerged during a relative drop in the sea level. The sequence boundary is the surface which separates the system tract of high sea level (HST) from the system tract of the low sea level (LST).

TS is the transgression surface, which is recorded at the point of sea level increase. The transgression
surface is the surface which separates the system tract of the low sea level (LST) from the transgressive system tract (TST).

MFS is the surface of maximum flooding, which is formed in the period of maximum transgression. This is a surface, which separates the transgressive system tract (TST) from the system tract of high sea level (HST).

The three surfaces indicated above are considered as the boundaries of system tracts, based on which it is possible to define the intervals of allocation of sedimentary system tracts (Catuneanu et al., 2011; Embry, 2009; Embry and Johannessen, 2017). Thus, the following system tracts are revealed within the sequence boundaries:

a) LST is the system tract of the low sea level, restricted from the above by the transgression surface and from the below by the sequence boundary. This system tract embraces the interval from the boundary, where the sea level starts to drop and until the first surface of flooding within the limits of the sequence.

b) TST is the transgression system tract, which is the intermediate system tract and is located between the surface of maximum flooding and transgression surface.

c) HST is the system tract of high sea level restricted from the above by the sequence boundary and from the below by the surface of maximum flooding. This system tract embraces the area from the maximum height of sea level until to the point of the sea level drop.

In the paper, in addition to the study of sand and clay content by use of correlation, the division of section into system tracts has been carried out and the thickness of sequences and sedimentation time intervals have been defined. The paper also considers results of analysis of lithology and facies (Belozerov, 2011).

Sedimentation rates vary depending on sedimentation environment. Despite the fact that time and rate of sedimentation of studied horizons already adopted by researchers are known, there is a requirement for repeated analysis in the light of new data (Seyidov, 2017). As three horizons are considered in the paper, the common average rate of sedimentation is adopted as 3750 m/mln.years.

With the aim of analyzing the lithology of the study target the logging curve data have been researched. For this, reservoir properties of sediments were evaluated by the values of apparent resistivity curves (AR), spontaneous polarization (SP) and Gamma-Ray Log (GR). In the study process the lithology through the section has been defined and two types of sediments were evaluated — sand and clay. In this case, interpretation and analysis of GR curves (intervals with values of intensity on GR curves less than 3.5 mR/h were assumed as reservoir layers) and SP curves allowed us to define their boundary values (normalized value of $\alpha_{35}$ calculated by SP has been taken higher than 0.6). These data also allow us to define the coordinates of location of reservoirs and cap rocks in three-dimensional space.

**Results and discussion**

A sufficient number of works is devoted to the research on the sedimentation environment of the Productive Series of the Pliocene based on well logging data. However, those works mainly consider the results of electro-facies analysis of terrigenous sediments (Kerimova and Aliyev, 2022; Seyidov, 2017; Khalilova and Kerimova, 2022).

The study target in this work is the Galmaz field. Despite the fact that the geological setting of the Galmaz area was researched by use of various methods, the study of the environment of sedimentation of PS by use of well logging data is reflected in a small number of scientific publications. Published papers consider in general the peculiarities of geology, reservoir properties and reservoir setting in the Galmaz field (Aliyeva and Aslanzade, 2013; Feyzullayev et al., 2022). For example, in one of these works (Aliyeva and Aslanzade, 2013) the reservoir architecture has been modelled and petrophysical parameters have been studied by use of core samples for further reconsideration of hydrocarbon reserves.

In another work (Feyzullayev et al., 2022) in the case of Galmaz area in the South Caspian basin the authors have made clear that one of the major geological factors defining the work mode of wells is the inhomogeneity of the reservoir, which is expressed in the form of spatial variation of its geological setting and petrophysical properties of rocks. Analysis of filtration-capacitance properties of rocks was made by use of core samples.

In distinction to the works published up to now, this paper displays the results acquired in the course of research on characteristics of the sedimentation process in the Absheron, Aghagyl stages and Productive Series of the Pliocene in the Galmaz area by use of well logging data subjected to sequence-stratigraphy.

**Results of the study for wells**

*For the well Qz-9* the analysis of 1100-2000 m depth interval made it possible to outline 7 sequenc-
es. These sequences were formed during the sedimentation process in the periods of progradation and regraduation. In some places, within the sediments of small thickness the aggradation process was observed.

Each sequence was divided into three system tracts. The section of the well and boundaries of sequences are displayed in Figure 1. Table 1 shows intervals between sequence boundaries, sequence thickness and the sedimentation period.

In the first sequence (Seq1) the jaggy bell curve of GR log is observed. The jaggy form of the GR log curve evidences the continuous variation of intensity of the sedimentation process. Its bell shape indicates the presence of transgression here. In this sequence, the progradation observed during the short time period was followed by a sharp retrogradation process. Within the limits of the sequence, the alternation of sand and clay layers is identified.

Within the limits of the second sequence (Seq2) the curve of GR has a jaggy concaved shape. The curvature of GR curve from foot to the top evidences the increase of clay content from the foot to the top. For this area, in general, the retrogradation process is characteristic.

In the third sequence (Seq3) the sharp ascents and descents are noted. The GR curve is bent and jaggy with the shape of a bell. This evidences the unstable nature of the sedimentation process. Alternation of sand and clay is observed here. However, it must be noted that sand dominates in the sediments. The insignificant alternation of progradation and retrogradation processes can be seen in this area.

In the fourth sequence (Seq4), the linear curve and jaggy curve of funneled shape are noted. The linearity of the curve approximately at the depth of 60 m evidences the stability of the sedimentation process. However, taking into consideration that the curve has a jaggy form, it can be stated that despite the insignificant variations in the sedimentation process, they did not have a serious impact on the process. The aggradation process had taken place here. The funneled form indicated above displays the retreat of the sea level and the presence of the progradation process. The sand constitutes almost 95% of the sediments accumulated within the limits of this sequence.

The fact that the GR curve, drawn within the limits of the fifth sequence (Seq5) has a jaggy convex shape, indicates that the phenomena of flood-and-ebb taken place here. Towards the middle part of the sequence, the increase of sandy fractions is observed. The drop in the sea level is observed from the foot of the sequence and its increase is recorded towards the top of the sequence.

The sixth sequence (Seq6) has the highest thickness. Sharp ascents and descents are observed within the limits of this sequence. Transgression and regression processes had sharp intensities, progradation and retrogradation replaced the each other, providing consequential alternation of clay and sandy fractions.

In the seventh sequence (Seq7) the curve is a jaggy bell curve. This evidences sedimentation during the process of transgression. Despite the dominance of sandy sediments in the foot of the sequence, the presence of clay increases towards the top of the sequence and a retrogradation process is observed.

In general, analysis of the seven sequences outlined within the section of the well display the dominance of jaggy curves, most of which are bell-shaped and funnel-shaped. The record of such curve types evidences the constant alternation of retrogradation and progradation processes. This stipulated the consequential alternation of sandy and clay fractions. Thickness and time period of sedimentation of each sequence in the well Qz-9 are shown in Figure 2.

Percentage of three system tracts within the limits of sequences outlined in the studied well is shown in Figure 3a.

Table 1. The sequences and time periods of their sedimentation, well Qz-9

<table>
<thead>
<tr>
<th>Well №</th>
<th>Sequence</th>
<th>Interval, m</th>
<th>Thickness of sediments, m</th>
<th>Time period of sedimentation, year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qz-9</td>
<td>1 sequence – Seq1</td>
<td>1138.8-1190.5</td>
<td>51.7</td>
<td>13,788.6</td>
</tr>
<tr>
<td>Qz-9</td>
<td>2 sequence – Seq2</td>
<td>1190.5-1328.0</td>
<td>137.5</td>
<td>36,646.8</td>
</tr>
<tr>
<td>Qz-9</td>
<td>3 sequence – Seq3</td>
<td>1328.0-1420.7</td>
<td>92.7</td>
<td>24,721.8</td>
</tr>
<tr>
<td>Qz-9</td>
<td>4 sequence – Seq4</td>
<td>1420.7-1539.3</td>
<td>118.6</td>
<td>31,602.8</td>
</tr>
<tr>
<td>Qz-9</td>
<td>5 sequence – Seq5</td>
<td>1539.3-1656.7</td>
<td>117.4</td>
<td>31,317.5</td>
</tr>
<tr>
<td>Qz-9</td>
<td>6 sequence – Seq6</td>
<td>1656.7-1854.1</td>
<td>197.4</td>
<td>52,621.5</td>
</tr>
<tr>
<td>Qz-9</td>
<td>7 sequence – Seq7</td>
<td>1854.1-1914.0</td>
<td>59.9</td>
<td>15,958.7</td>
</tr>
</tbody>
</table>
The largest portion of the sequences belongs to the transgressive system tracts. Within the limits of transgressive system tract there is an interval from the point of start of sea level increase from its minimal level to the point when it reaches the maximum level. Within this tract, the source rocks are with oil content. Retrogradation process is observed here.

In the other three wells (Qz-13, Qz-16, Qz-19) the studies were conducted as indicated above. The acquired results are shown below. In section of well Qz-13 the number of outlined sequences are seven with three system tracts in each of them. Of these system tracts, the one with lowest thickness is the system tract of high sea level. Thickness
of this tract is 168 m. It is featured by alternation of sand and clay. Thickness of the system tract of the low level constitutes 270 m. This tract consists of sandy diversities and hydrocarbon reserves are accumulated here. Thickness of the transgressive system tract is 310 m and here the oil bearing rocks dominate in the source rocks. Sedimentation time period is 199,430.2 years. The percentage is as following: HST – 22%, LST – 36%, TST – 42%.

In the section of well N16, which embraces sediments with thickness of 776 m, we have outlined seven sequence intervals. Sedimentations of these thicknesses were accumulated over approximately 206,850 years. The record of funnel-shaped and bell-shaped curves in the short intervals within this time period indicates that the processes of transgression and regression were rapid. The concaved and convex shapes of the curve indicate mainly the gradual variation of the sea level. The jaggy linear shape of the curve observed in the last sequence shows that variations in sedimentation process had low intensity and reflect alternation of clay and sand. In this well the system tract of the low sea level is featured by the highest thickness. The percentage here is as following: HST – 25% and is represented by alternation of clay and sand; TST – 34% and is mainly covered by the retrogradation process and made of source rocks of 260 m thickness; LST – 41% and is made of sandy fractions.

In the section of well Qz-19, seven sequences were identified, in which the processes of retrogradation and progradation occurred. The period of sedimentation lasted 203,024 years. Distribution of system tracts is as following: HST – 19%, TST – 32%, LST – 49%.

50% of the share falls on the transgressive system tract and the high sea level system tract, where alternation of clays and sands is observed and the source rocks are present.

Sequence-stratigraphic correlation performed on the basis of well data allows us to gain knowledge on
the processes during the sedimentation, on how the sediments were formed, conditions of their accumulation and lithological composition. The results of the sequence-stratigraphic analysis of four wells of the Galmaz field and the relationship between the wells are shown in Figure 4.

Results of sequence-stratigraphic correlation displayed that continuous ascents and descents of the sea level had caused sediments to accumulate in various directions through the area, with diverse allocation. Along the analyzed section of the well on the log curves we observe sharp ascents and descents, jagged shapes, bell-shapes and funnel-shapes. Such record of curves is related to regression and transgression processes during sedimentation. The sequence-stratigraphic analysis is also based on the outline of boundaries of sequences generated during the uplifting and depression of the basin.

Thus, in the process of regression the basin is depressed, i.e. the sea digressed from the coast. During the transgression the forward motion of the basin was assisted by the process of sea level ascent. We have outlined the surface of maximal flooding at the maximum point of high sea level, transgression surface at the start of sea level ascent and boundary of the sequence at the start of sea level descent and this made it possible to trace seven sequences in the section of each well under consideration. Three system tracts have been outlined and analyzed in each sequence. In the process of comparison of data acquired in all wells the total volume of each system tract has been calculated (Fig. 3b).

Based on the analysis of the studied well sections, it can be said that the major part of the section of the Galmaz area consists of system tracts of low sea level. Total thickness of the system tracts of low sea level is approximately 1250 m and this constitutes 41% of the total thickness of the section. Analysis allows us to establish the accumulation of reservoirs, sandy particles and their varieties within this tract. Over the system tract of low level there is also the transgressive system tract, which consists mainly of the source rocks, supposedly of clay and coal with a thickness of 1100 m. The data on oil and gas presence in the studied region confirm the presence of reservoirs within outlined system tracts of low sea level.

Thickness of the system tract of high sea level is about 701 m. This tract consists of alternation of sand approximately of the same size of particles and the clay.

Correlation of well sections shows that reservoirs of the system tract of high sea level, the transgressive system tract and the system tract of low sea level are continuously alternating and structurally become thicker towards the basin. This proves the relation of structure of sediments to the stratigraphy.

Sedimentary composition of the system tracts, creating the sedimentary sequence, varies depending on generation conditions. It can be seen from the section that allocation through the area is diverse during the geological era. It can be said on the basis of correlation that the sequence of sedimentation is relatively conformable (no large unconformities) and the layers are tied with each other.

Analysis of well sections displayed that the values of GR, SP and AR curves are characterized by inconsistent values at various intervals. Such inconsistency is evidence that the geological section of the Galmaz area was accumulated at various rates and under frequently varying energy conditions. Alternation of sand and clay-caps, accumulated as a result of variation of the coast line, was the cause of weakening or almost the total loss of ties between the layers.

Sequence-stratigraphic analysis applied to the stages of Absheron, Akchagyl and Productive Series confirmed the dominance of reservoir rocks in these horizons. Allocation of reservoirs through the Galmaz field is shown in Figure 5.

The study revealed that Akchagyl sediments accumulated at high sea level play the role of major cap of the regional scale in the basin. These sediments are characteristic mainly for coastal lines, transgressive and sedimentary environments. These deposits are featured by good reservoir properties and the source rocks presence. Evolution of reservoirs of Akchagyl horizon is tied to the similar sedimentation mode. The end of the each cycle is finalized by transgression. In this case, the targets consisting of coastal sandstones with good reservoir properties are covered by impermeable clay rocks.

It has been established that parasequences of Absheron stage and Productive Series were formed in the process of progradation involving the detritus brought by river flows.

Thus, the following results have been derived in the study process:
- bell-shapes, funnel-shapes and jaggy shapes were traced on the logging curves and this indicates that each of the facies represents the processes of sea transgression and regression, as well as variation of the environment;
- the lithology and thickness of sediments accumulated in each facies have been defined;
- based on the sequence-stratigraphic analysis of the oil field-geophysical data it has been made clear
that the geological section of the Galmaz area was formed at various rates and at frequently changing energy modes;
- parasequences of Absheron stage and Productive Series were formed in the process of progradation with involvement of detritus brought by the river flows;
- Akchagyl sediments play the role of the basic cap of the regional scale in the basin.

Conclusions

The conducted sequence-stratigraphy research provides evidence that rhythmic alternation of clay and sandy rocks in the studied section of the area is related to variation in the sedimentation process within the system of river-lake (sea), stipulated by sea level fluctuations. The sedimentary composition of the system tracts outlined within the sequences varies depending on conditions of formation.

The geological section of the Galmaz area was formed under frequently changing energy conditions.

The main hydrocarbon accumulations in the Galmaz area are within the Absheron stage and Productive Series of Lower Pliocene. It has been made clear that the major hydrocarbon accumulations are attributed to the facies of system tracts of low sea level and rarely to the transgressive system tracts. De-
The approach offered in this paper makes it possible to study well sections in more detail, perform litho-facies analysis in order to reconstruct sedimentation process both along the well section and across the study area.

Fig. 5. The map of reservoirs’ allocation: a) Absheron horizon, b) Akchagyl horizon, c) Productive Series in the Galmaz area