Oriented core application in texture analysis of J_1 formation in Kazan oil-gas condensate field (Tomsk Oblast)

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Abstract. The paper describes the results of the characteristic structure features of oil-bearing rocks via paleomagnetic oriented cores. Volume core model is plotted on the basis of circular panoramic images. In applying scanned panoramic core it is possible to determine the azimuth of terrigenous material transportation and its course and to describe its sedimentation environment in details.

1. Introduction

Kazan oil/gas-condensate field is located in east central Western Siberian lowlands within Tomsk Oblast. The geological profile embraces argillo-arenaceous sediments of Mesozoic-Cenozoic sedimentary mantle, superimposing the metamorphosed rocks of Paleozoic folded basement. Layer J_1 of Vasugan suite is a major hydrocarbon-bearing formation, extending horizontally and vertically and tapped in all drilled wells within Kazan field structure.

2. Research methods

Research target involves core samples of layer J_1 oil-bearing rocks from Kazan field wells. Sampling description embraced a core column of 130m. Paleomagnetically, there are 25 oriented core samples from two field wells. Core panoramic scanning was conducted on the basis of present sample data. Such core sweeping provides the possible tracing of changing texture features in volume, including orientation and layer incidence angle, distribution patterns and relations, quantitative ratio and other characteristic features of sedimentary formations.

3. Results and discussion

Layer J_1 sediments include medium-fine grained sandstones and argillo-arenaceous rocks. Previous studies in lithological and mineralogical-petrographical rock features have been described [1]. Based on the classification of textures and bedding types of core samples from investigated intervals, the following texture and rock stratification types were determined (table 1, figure 1).

Facies dismembering involves the macrofauna classification of Jurassic sediments [2]. Analysis of identified texture-structure features and rock granulometry, which, in its turn, include fauna remains and clastics revealed the sedimentation environment as basin type. It was determined that sedimentation occurred in shallow-water basins under conditions of flowing shallow open basin water (SBW) or under conditions of offshore (open) basins (OB).

The first (SBW) are characterized by intensive matter accumulations, transported from outboard shore to its rear area by alongshore currents. The rocks formed in such environments are typically well-sorted and rounded clastics, low-inclined cross-bedding and regionally banded structures.

The second (OB) can be found in outboard basin shores. The environment here is predominately coastal-marine, associated with lower lowland rivers. This macrofacies embraces clay, aleurolite and sandstone formations of marine sediments Depending on the marine fauna, which can be found in the sediments, these sediments are transported to this or that facies. The rocks formed under such conditions possess horizontal bedding, and are well-sorted.

Table 1. Structure and bedding types in J_1 sandstone layer, well X, Kazan field.

Structure	Bedding
Unstratified: homogeneous (massive), nodular and lumpy	Lenticular (lenticular-wavy), linguloid, weakly-strongly disrupted
Indistinct bedding: placic with rare inclusions and laminae	Wavy (cross) non-parallel, weakly-strongly disrupted
Disrupted creeping and roiling	–

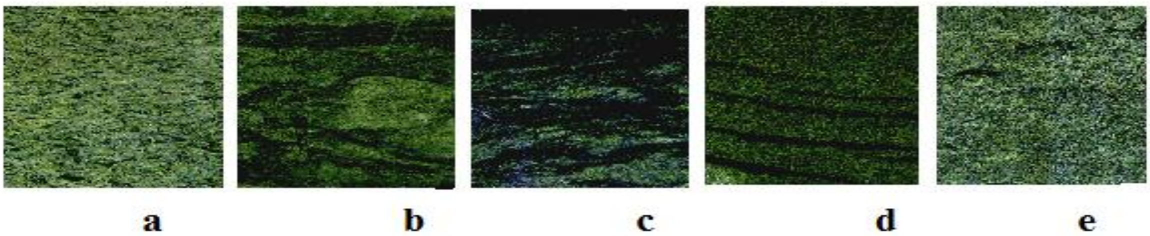

Figure 1. Examples of structure and bedding types of rock layer J_1
a) Fragment of homogeneous massive structure of solid fractures shells.
b) Fragment of placic fine-grained alliterate-argillite sandstones.
c) Fragment of lenticular bedding, governed by the argillite in sandstones as laminae and lenses of first millimeters to 3 cm thickness and strong irregular gradual boundaries.
d) Fragment oriented to locations of weakly disrupted aleurolite-argillite sandstones.
e) Fragment of indistinct structure with rare inclusions.

Applying circular scan made it possible to plot a volume model of the investigated core samples in order to determine and define the rock structure features. Preliminarily, via paleomagnetic method, the core was north – oriented, and in this case, the viscous magnetization component, i.e. the angle between the present north line and sediment formation was scanned on the magnetometer, determining the sample orientation to Jurassic period. Plotting volume core scan is less time-consuming and resource -consuming comparable to 3D-scanning of inner well bore (figure 2).

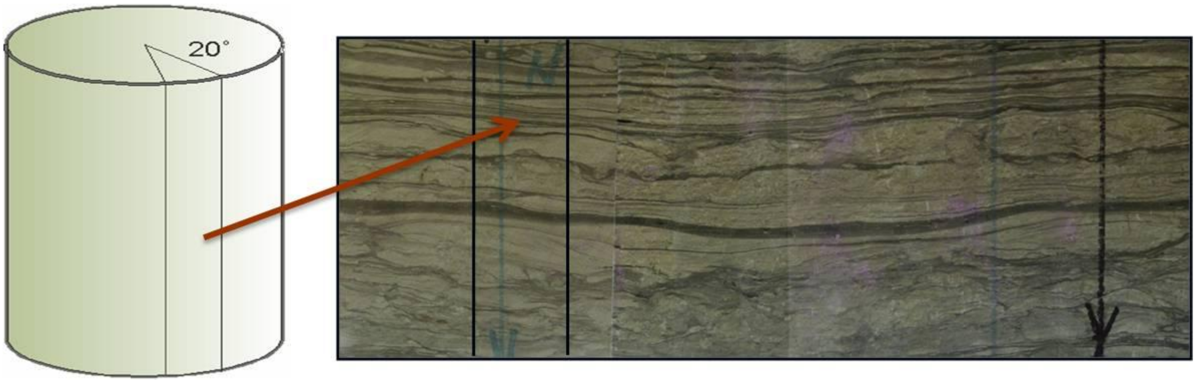

Figure 2. Core scan profile.

Based on produced core samples the structure types were classified and bedding types were also defined. In general, a log of similar structure types was plotted northward in depth (figure 3).

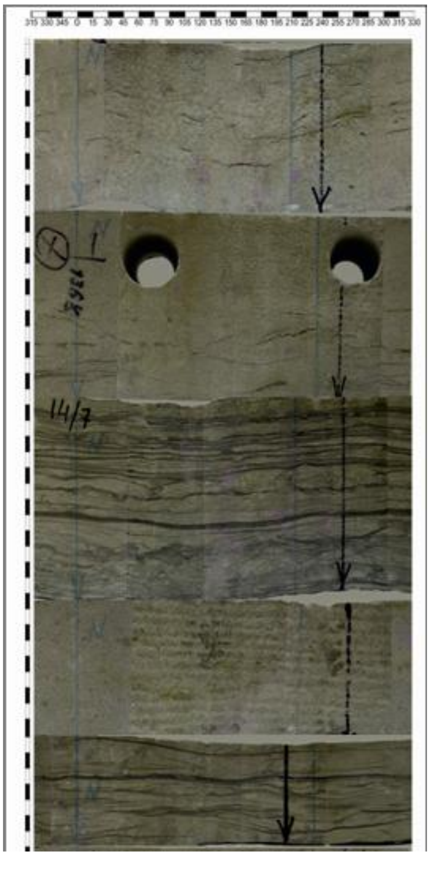

Figure 3. Core scan fragment at 360°, northward- blue arrows (Kazan oil field, layer J_1, well X).

Based on paleomagnetically-oriented core samples, the azimuth of matter transportation and course was determined, and respectively, sedimentation environment was described in details. In this case, the circular scan of core sample was adjusted so as north corresponded to zero degree (zero mark). Further, the maximum and minimum layer mark was established and the corresponding angles were determined by a scale.

For example, in figure 4, the maximum and minimum curvature point in discussed sample layer is located on the azimuth of 87^{o} and 270^{0},which, in its turn, indicates that the direction of matter transportation and course is W-S-W to E-N-E. The low angle wavy cross bedding reveals existing unstable environments in which matter transportation and further accumulation occurs. This is characteristic of coastal-marine environments. Obtained results are completely verified by facies distribution data and microstructural – morphological investigations of core samples from oil-producing reservoirs [3].

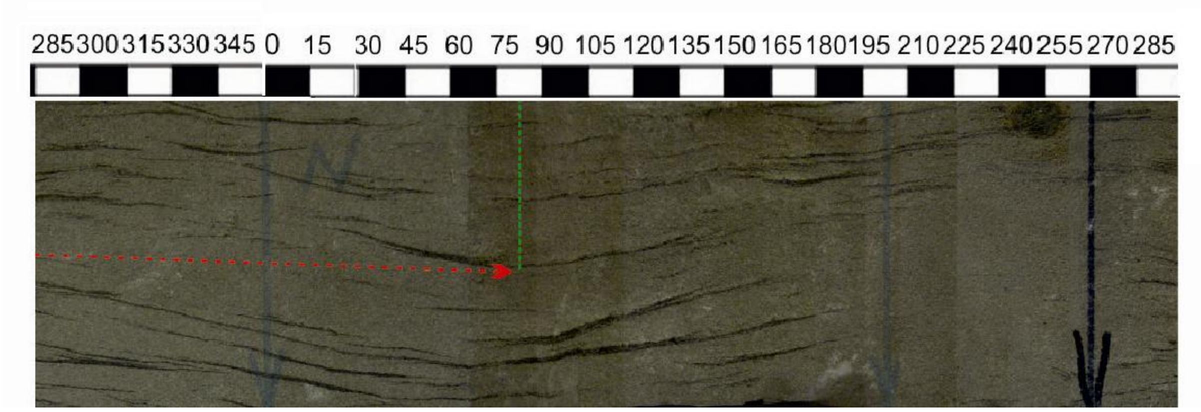

Figure 4. Azimuth line determination of matter transportation and lamina formation based on sample X (Kazan oil-gas condensate field, layer J_1).

4. Conclusion

It should be noted that recent paleomagnetically-oriented coring has been applied in investigating the sedimentary rocks in hydrocarbon-bearing deposits. The produced circular (volume) core scan not only reveals the spatial image of bedding and structure features, but also presents details of the rock fabric and, respectively, accurate data of sediment formation environments.

References

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