Fracture density in the Bashkirian deposits of the eastern side of the Melekess depression

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A presence of natural fractures in rocks is a common geological phenomenon. Rocks with fractured porosity are found almost all over the world. Fractured reservoirs are related to geological structures that differ in age, lithological composition, and burial conditions. The fracture porosity in some fields leads to increased reservoir permeability and high flow rates. Respectively, the knowledge about the fracture density and value of natural fractures porosity is an essential factor for choosing reservoir development strategy.

Logging and core data from several oilfields, located on the territory of the Republic of Tatarstan (Russian Federation) were studied (Fig.1). The Bashkirian deposits are one of the main carbonate sources of hydrocarbons.

Fig. 1. The position of study area with the location of two sites as a case study

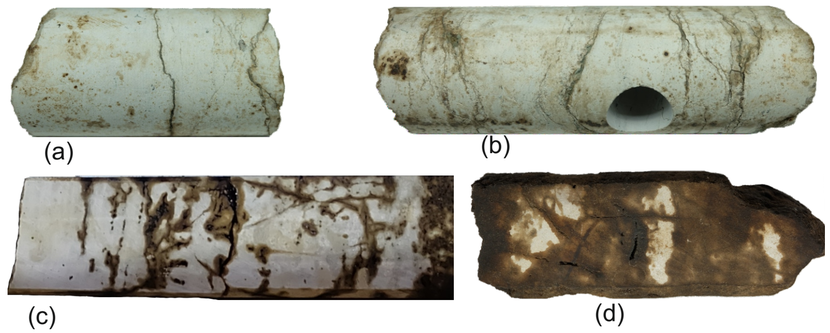

Fig. 2. Examples of core samples from Zone 1 (a, b) and Zone 2 (c, d)

The Bashkirian deposits in the studied area has a three-membered structure. During the transition from top to bottom from the deposits of the Vereiskian horizon to the Bashkirian deposits, a porous layer of variable thickness is distinguished in the section. Beneath it there is a dense layer with an average thickness of nine meters, characterized by the presence of a large number of cracks mostly sealed with clay material (Fig.2, a,b). The fracture density in this part of the section reaches 15 fractures per 1 m.

The middle pack is characterized by the increased porosity and is the main object of oil production. In this zone, large formations with pore, pore-cavern and pore-fracture hollow type are presented (Fig.2, c,d). The non-reservoir rocks in this zone are characterized by a significant number of conductive (mostly) cracks with various lengths. Permeable layers are mainly characterized by low value of the fracture's density (on average 3-5 fractures per 1 m). However, in some wells, permeable layers with an increased density of conductive cracks (up to 20 fractures per 1 m) were noted in the lower part of the second section (Fig.3).

In the lower part of the section of the Bashkirian formation, an increase in rock density is observed once again. However, this section, unlike the upper part, is characterized by the presence of a significant number of conductive fractures (up to 10 fractures per 1 m). This point should be taken into account when planning waterflooding or hydraulic fracturing to prevent water breakout from the lower aquifers.

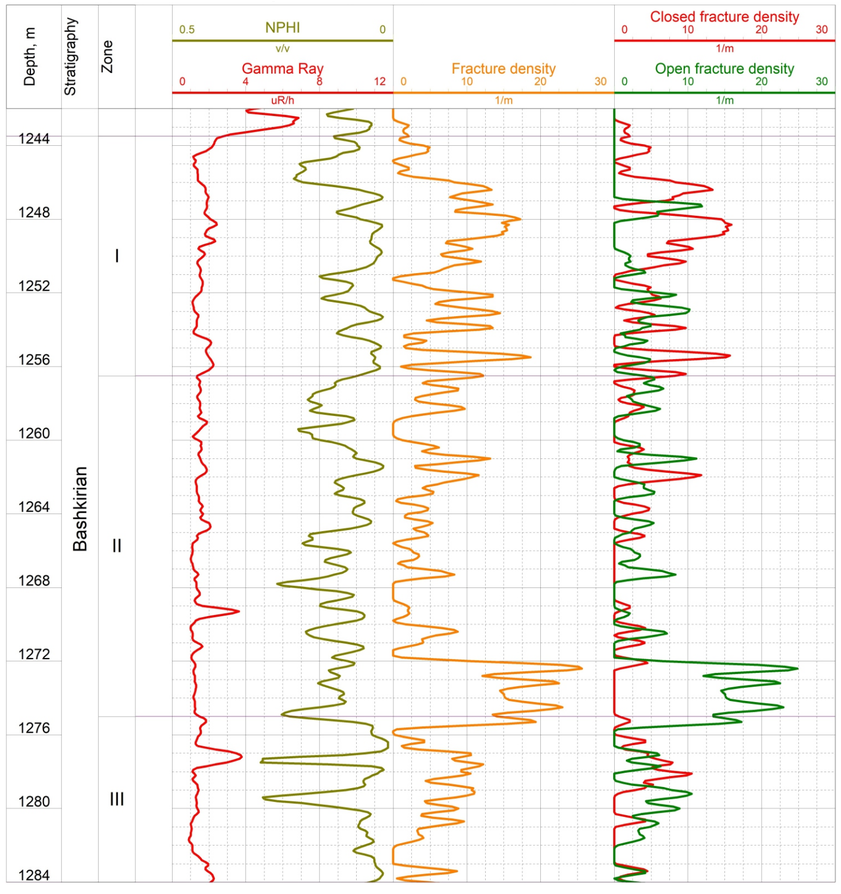

Fig. 3. Examples of well log data: Track 1 shows gamma ray in red and neutron total porosity (NPHI) in brown, respectively. Tracks 2 and 3 shows total fracture density and for open and closed separately.