

Distribution of organic matter in Callovian–Lower Berriasian deposits of the western part of the Yenisei–Khatanga regional trough and adjacent areas of the West Siberian geosyncline

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Abstract

This study presents the results of geochemical analysis of organic matter and paleogeographic reconstructions supplemented by data from well log interpretation and cyclostratigraphic analysis for the Vasyugan, Georgiev, and Bazhenov Horizons of the Callovian–Lower Berriasian section in the western part of Yenisei–Khatanga regional trough and adjacent areas of the West Siberian geosyncline. It was found that each horizon contains zones dominated by terrigenous, mixed, and aquatic organic matter. The distribution of different types of organic matter over the area and throughout the section has been examined. It was shown that the accumulation of aquatic organic matter took place in the deepest parts of the trough during the Callovian–Oxfordian. The area of accumulation of aquatic organic matter expanded considerably and reached its maximum extent within the Bolshaya Kheta megasyncline during the Kimmeridgian and Early Volgian and in the west Yenisei–Khatanga regional trough during the Volgian and Early Berriasian.

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Introduction

The Yenisei–Khatanga regional trough (YKRT) and adjacent areas of the West Siberian geosyncline (WSG) in the Arctic regions of Siberia are as yet not sufficiently explored, but have significant potential for oil and gas discoveries in the Jurassic–Cretaceous sedimentary complexes. Despite the predominance of gas and gas-condensate accumulations, the major oil potential of the study area is related to commercial reserves of the Vankorskoe, Baikalovskoe, and Paiyakhskoe fields.

According to the current understanding, the Bazhenov Formation (Volgian–Lower Berriasian) is the main source of liquid hydrocarbons in the sedimentary cover of the West Siberian megabasin, which comprises carbonate-siliceous-clayey rocks rich in plankton- and bacteria-derived (aquatic) organic matter (OM). To the northeast of West Siberia, the Bazhenov Formation is replaced by clayey and sandy-argil-

laceous time-equivalent strata of the Gol'chikha and Yanovstan Formations (Fig. 1). These rocks show a dominance of terrigenous OM derived from higher plants and mixed OM. At the same time, aquatic organic matter is also present at some levels in the Yanovstan and Gol'chikha Formations (Afanasenkov et al., 2015; Goncharov et al., 2011; Kim and Rodchenko, 2013; and others).

Integrated geochemical analyses of core samples can be used to describe the organic matter type from the source rocks. However, incomplete sampling coverage of the section requires additional techniques for reliable results. Callovian–Lower Berriasian sediments in wells, including uncored intervals, were divided into interval depending on the OM type. The distribution of different types of organic matter in the section and over the study area substantially improves the information and hence the reliability of predictions of possible accumulations of liquid and gaseous hydrocarbons in the western part of the YKRT and adjacent areas of the WSG. This study was based on the results of geochemical analysis of core samples, supplemented by the data from well logs, cyclostratigraphic and paleogeographic reconstructions.

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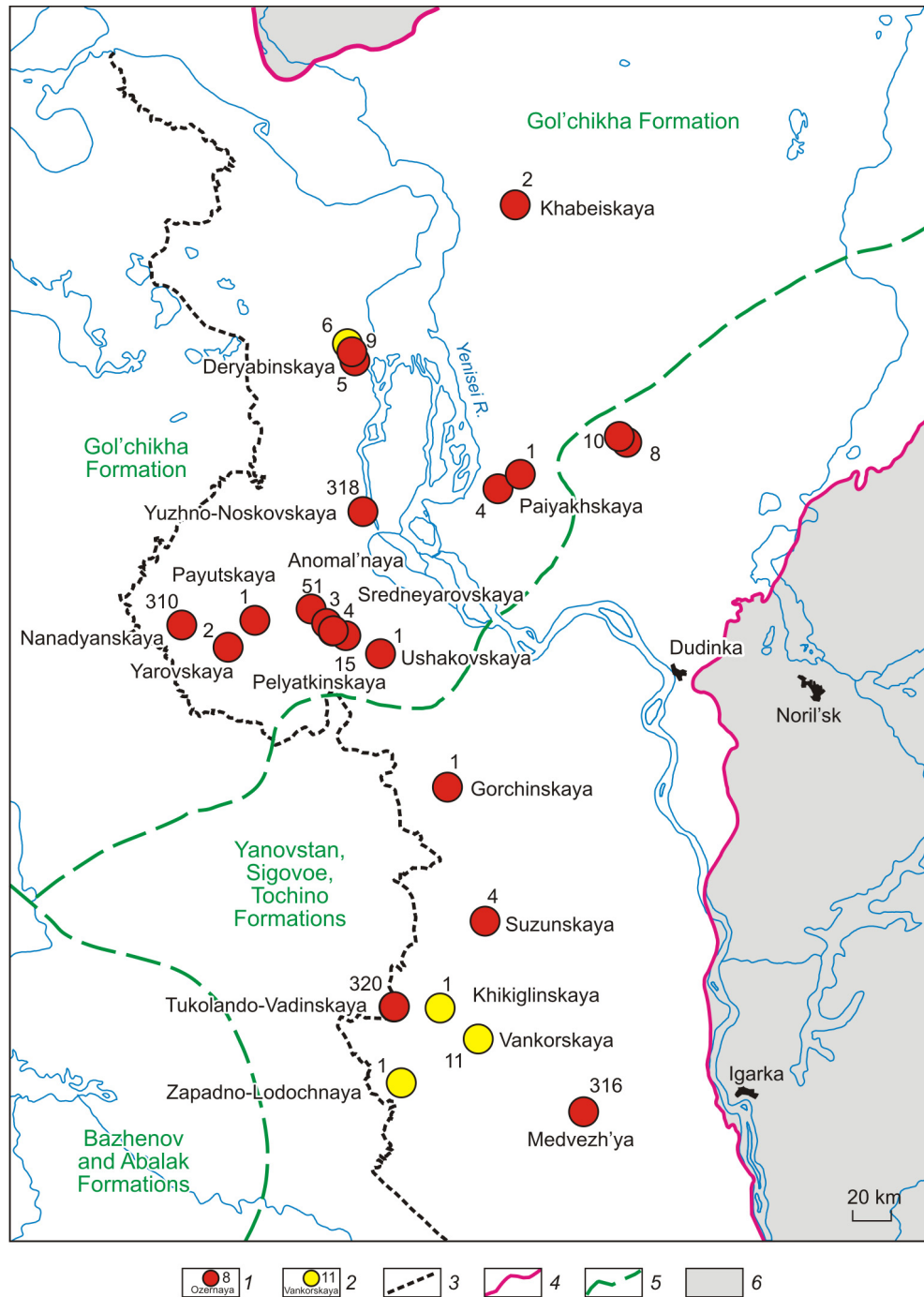


Fig. 1. Sampling points used for geochemical studies. 1, 2, prospect and well: 1, proprietary data of IPGG SB RAS; 2, literature data; 3–5, boundaries: 3, administrative, 4, Mesozoic deposits, 5, facies regions; 6, zone of missing Mesozoic deposits.

Geological and depositional setting

Two types of Callovian–Lower Berriasian sections (Taz–Kheta and Gydan) were identified in the western parts of the YKRT and adjacent areas of the WSG. The first type sections are represented by three formations (from base to top): Tochino, Sigovoe, and Yanovstan, which pinch out toward the flanks of the trough along the boundary with the Siberian platform. Callovian–Upper Jurassic deposits are absent on

crests of the Messoyakha, Semenov, and Malaya Kheta local uplifts (Isaev et al., 2009; Kontorovich et al., 2013; and others). These rocks were partially eroded down to different depths at the Soleninskaya, Zimnyaya, Dzhangodskaya and some other prospects within the Messoyakha inclined ridge and Rassokha inclined megaswell. The second type sections (Gydan) are represented by the Gol'chikha Formation, the time equivalent of the Tochino, Sigovoe, and Yanovstan Formations (Decision..., 2004).

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