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Journal of Geochemical Exploration 89 (2006) 373–375

JOURNAL OF
GEOCHEMICAL
EXPLORATIONwww.elsevier.com/locate/jgeoexp

Formation of hydrocarbon reservoirs in the deep Earth's crust

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Received 21 September 2005; accepted 20 November 2005

Available online 15 March 2006

Abstract

Formation of reservoirs in crystalline rocks is associated with the development of rifts, with the periodic axial plunge of the rift floor during the extension of the Earth's crust, and with the elevation of consolidated basement masses during a compression phase. © 2006 Elsevier B.V. All rights reserved.

Keywords: Geodynamic; Deep Earth's crust; Continental drilling; Fluid

1. Introduction

The 20th century can be characterized by the dominance of the organic theory of oil generation, which has always been considered to be a scientifically grounded theory. However, the assertion that natural petroleum might have arisen from biological detritus (organic matter) in the regimes of pressure and temperature found in the crust of the Earth has long been recognized to be in glaring violation of the fundamental laws of thermodynamics (Kenney et al., 2002). Furthermore, recently acquired geological information cannot be explained from this viewpoint. For example, giant oil fields would require of organic matter for their generation amounts that obviously exceed the Earth's organic resources.

2. Geology

The geodynamic evolution of the Russian Plate since the Late Proterozoic is characterized by perio-

dical, vertical movements of large structural elements such as the Tatarstan Arch and the Perm-Bashkirian Arch that are represented by the Kazan-Kazhim and the Kamsko-Belsky rifts. The rift-and-trough system of the Russian Plate, that in turn created the Tatarstan Arch, began to form in the early Late Proterozoic. This system was produced by the extension of the Earth's crust that led to the formation – at the boundaries of the consolidated crystalline cores – of deep frontal faults dipping toward the plunging rifts. As a result, the Tatarstan Arch in the Riphean time became a horst-like body, similar to the White Tiger of the Mekong rift and the Hurgada horst of the Suez graben's slope.

3. Methodology

The development of new exploration methods, such as satellite surveys, deep marine and continental drilling, and the substantial improvement of the existing ones (for instance, seismic profiling) — all permit the acquisition of the deep Earth's structural data, and the review conventional geological concepts. One of them is the formation and filling of large oil deposits at a great depth.

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