

NEW SIGHT ON THE DEEP STRUCTURE OF THE RUSSIAN PLATFORM CENTER ACCORDING TO THE MODERN REFRACTION INTERPRETATION

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Full information on structure of the Russian platform and nonindustrial appearances of oil and gas at some wells attract the great interest of geologists and give impetus to explore this region more carefully.

Seismic refraction exploration in the central part of the Moscow syncline (the Russian platform) was carried out by "Spetsgeofisica" in the 1960s and 1970s for mapping the top of the basement. Because of the subject of the work, the distance between shotpoints was chosen from 7 to 20 km and between geophones it was 100 m, only first arrivals being used. The data were treated by the wavefront method. A boundary was marked at the depth of 3 - 3.5 km. It was believed to be a top of the basement.

Reinterpretation of old seismic data using modern technique developed in Moscow State University brought more information. The technique of the interpretation is based on the 2D inhomogeneous model of velocity field and uses the program packet "GODOGRAF" that was successfully applied for the processing of various refraction data (first arrivals, observed traveltimes of refraction waves) acquired in different areas including regions of complex structure of the Earth's crust. Control over the results is provided with a special program using the ray-tracing method solution.

Fifteen profiles located within the Moscow syncline, crossed the Sredne-Russkiy aulocogen in the Eastern European platform and have been treated before were reinterpreted using program packet "GODOGRAF"(fig.1). As the result of that work cross-sections with isolines of velocities, a map of the basement relief, additions and corrections for tectonic map were obtained and rift zones were localized. Reinterpretation results correlate with CDP, gravimetric and wells data.

As was found the previous boundary which was considered early as the basement top coincides with upper boundary of synrift deposits which may be identified as the Riphean - early Vendian formation. On our cross-section it can be seen that the basement top was located much deeper and the greatest depths of it are about 6 - 8 km in the center of the rift.

Example:

The present cross-section is constructed by program packet "GODOGRAF" using data of the profile "Vologda - Kostroma" which is directed from the north to the south and extends for 210 km in length (fig. 2). The inner rift structure can be seen in the fig.2.

The first layer lies under the 4.7 to 5.0 km/s isolines and is characterized by a higher

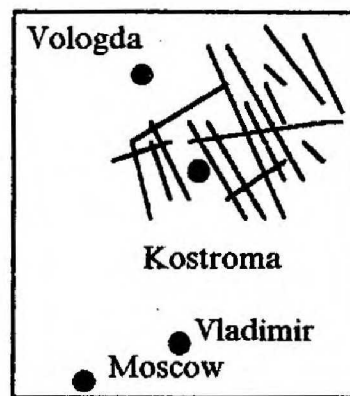


fig.1 Scheme of the profiles.

PROFILE VOLOGDA - KOSTROMA

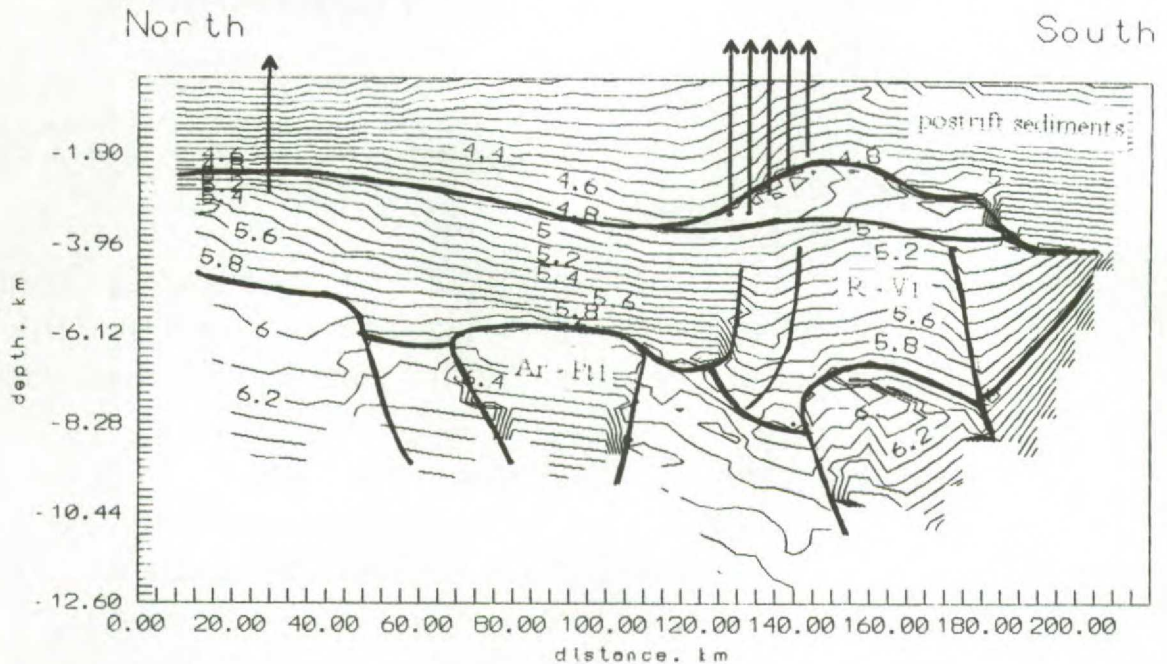


fig.2 2D seismic cross-section " Vologda-Kostrorna ". Thin lines indicate 0.1 km/s. The faults and the boundaries are shown by the bold lines.

velocity gradient. It can be identified as a postrift formation. Unfortunately, the system of data acquisition did not permit to determine the inner structure of this formation.

The second layer is limited by the 5.0 to 6.0 km/s isolines. Rift zone stretches out from the point of 126 to the point of 186 km and is distinguished by a lower velocity gradient. The position of the layer's top is in close agreement with the wells data. The northern part of this layer has a wedge form. This structure was formed with Riphean-Vendean rocks. It is necessary to stress that these deposits are of the greatest interest for oil and gas exploration.

The top of basement is clearly traced as a second-order boundary lied near of the 6.0 km/s isoline along the cross-section. At the northern part of the profile the depth of the basement gradually increases from 5 to 7.8 km near the point 143 and 7.5 km near the point 174 within the rift zone. Crystalline basement is broken down into inhomogeneous blocks probably identified as the Archean-Proterozoic formation. On the cross-section protruding upward block of the points from 80 to 120 is in a contact with descended ones by slope faults. In the rift zone the basement is represented by complex system of grabens.

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