Catagenesis of Organic Matter and Oil-Gas Prospects of Triassic Sediments of West Siberian Platform

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The Triassic System of West Siberia formed in two large stages. In the first (Early Triassic - Anisian) deposition was under arid and semi-arid climate along with volcanic activity. In the second (Late Triassic - Ladinian) deposition was normal with a humid climate. The Triassic was penetrated by the first stratigraphic wells drilled in the south of the West Siberian platform. These rocks were found also in the coal basins of the east flank of the Urals and in outcrop in the Polar Urals.

The Triassic section of West Siberia is generally subdivided into three large parts: Tampey, the synchronous Turin Series, and the Chelyabinsk Series. These differ in lithologic composition, conditions of deposition, and distribution. The volcanic-sedimentary Turin Series occurs in graben-like depressions in the area of the middle and lower course of the Ob River and to the southwest of it. It rests discordantly on deformed Precambrian and Paleozoic rocks. This series was deposited largely under arid and semi-arid conditions as red beds. Its age is in the upper half of the Induan of the Middle Triassic and in part Upper Triassic.

The Chelyabinsk clastic-coaly sediments (Rhaetic-Lias) were deposited in grabens along the east flank of the Urals and west and east flanks of the Central Kazakhstan Shield. They rest discordantly on Paleozoics and even on Turin rocks. Both these series fill large graben-like depressions that are bound locally by overthrust faults.

The Tampey Series consists of silt-clay rocks of inherited downwarps. It is present largely to the north of the Siberian Highground (Uval). Small downwarps filled with Tampey rocks occur also in the southeast of the West Siberian platform. The age has been determined from spore-pollen associations. They consists of uniform argillites along with beds of siltstone and sandstone.

Up until now there have been practically no studies of the catagenesis of the organic matter of the Triassic rocks of the study area. This is due in considerable degree to their great depth of occurrence and consequently the small number of wells that have reached this part of the section.

The present study determined the catagenic level in Triassic clastics in 14 exploration areas in various parts of West Siberia. See figure 1. This level ranges from Mk-1 to AK-2. The least altered organic matter is found in the southeast of the region. There in the Severo-Lymbel area of the Pyl'-Karamin mega-swell the maturity is at the MK-1 level (Ro=0.55). Catagenesis is somewhat stronger to the south, although in the Vanzhil area it does not exceed the middle of MK-1 (Ro=0.59). Farther in this direction there is continued increase in maturation of the organic matter, reaching MK-12 (Ro=0.70) in the Zapadnaya area.

It is true that here the Triassic sediments occur almost 1.0 km deeper than in the first areas cited. It is possible that the difference in paleo-depth was also substantial. Maturation of the organic matter at the top of MK-1 (Ro=0.64) has been established in Sherkalin area of the Uvat-Khanty-Mansiysk micro-plate. The same level of maturation is found for the top of the Triassic and base of the Jurassic (MK-12, Ro=0.76) in the Omsk area. Greater maturation is found in Rogalev area of Nyorol depression. Here Ro at 1.12 to 1.16 is characteristic of the top of MK-2. Similar values are recorded in Yuzhno-Russkoy area of Chasel mega-swell in the north of West Siberia. Here the same values at the middle of MK-2 (Ro=1.0) are recorded for the base of the Jurassic and top of the Triassic.

The greatest thickness of the Triassic section at about 1.2 km is in Nikol well 1 in Omsk Region. In the upper part of this section the maturation is at the beginning of MK-31 (Ro=1.2). This parameter increases downward in the section, although slowly. At depth of about 4 km the level of maturation is in the middle of MK-31 (Ro=1.4), and then at bottom hole (4.5 km) it is at MK-32 (Ro=1.56). All this takes place in an interval of section that exceeds 1 Km. Contact alteration of the organic matter is found at depth of 4.2 km in direct proximity to an igneous body. Maturation there is at AK-3 (Ro=3.85).

At a distance of a few tens of meters from the contact the catagenic level is back to normal level, that is, the effect of the igneous body on maturation is felt over a relatively short distance. A characteristic feature of the Triassic rocks of well Nikol-1 is absence of substantial differences in maturation of the organic matter in passing from the Jurassic into the Triassic. Maturation in the basal beds of the Jurassic is in the middle of MK-2 (Ro=0.97-1.04), whereas at the top of the Triassic it is at MK-31.

Relatively high catagenesis of the Triassic organic matter is recorded on the Nizhnevartov arch of the south of West Siberia. There