Regularities in Sedimentary Cover of Timan-Pechora Platform


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The Timan-Pechora platform is to the northeast of the epi-Karelide craton of the Russian platform. Basement was consolidated as a result of pre-Late Cambrian orogenesis, and the sedimentary cover began to collect in Late Cambrian(?)-Early Ordovician time. Most of the sedimentary cover is Paleozoic and Mesozoic; hardly any Cenozoic is present. Total thickness in the central part of the platform is 4-7 km and 10-12 km in the Cis-Ural foredeep. Thickness above highs is 3-4 km.

Timan-Pechora platform is located between the stable East European craton and active regions: Ural mobile belt on the east and Barents Sea rifts on the north. This is reflected in transition from intra-continental rift facies to shallow-water shelf facies to reef and depression facies on the continental slope, and molasse, coal-bearing and evaporite facies in the Cis-Ural foredeep.

Three main orogenic cycles are recognized in the region: Caledonian, Hercynian, and Cimmerian-Alpine. Accordingly several structural stages are recognized, bounded by regional discordances: Caledonian, Ordovician-Early Devonian, Early Hercynian, Middle Devonian-Tournaisian, Middle Hercynian, Permian-Triassic, Jurassic-Cretaceous, and Paleogene-Neogene. The section is also subdivided into petroleum complexes.

The subdivision of the section presented here is based on rhythms of sedimentation governed by changes in sea level of the world ocean and by tectonic processes. Eight rhythms are recognized in the Paleozoic: Late Cambrian-Early Ordovician, Middle-Late Ordovician, Early Silurian-Ludlovian, Pridoli-Early Devonian, Middle Devonian-Tournaisian, Middle Hercynian, Permian-Triassic, Jurassic-Cretaceous, and Paleogene-Neogene. The section is also subdivided into petroleum complexes.

The Late Cambrian-Early Ordovician rhythm (0.4-3.0 km) occurs in complete section only in the east and in the Urals. In a large part of the platform this rhythm is represented by Lower Ordovician. The upper part of the rhythm, the Arenig, is probably widely distributed in the west. The base of the rhythm rests discordantly on basement. The rocks are largely alluvial-deltaic clastics grading upward into near-shore marine facies. Marine limestones are present in the east.

The Middle-Late Ordovician rhythm (0.1-1.2 km) is transgressive on the previous rhythm and basement. It is largely a shallow-water shelf facies. From northwest to southeast and east variegated detrital carbonate deposits pass into clay-carbonate. Reef deposits appear in the upper part of the rhythm in the extreme east. In a large part of the platform the section of this rhythm is incomplete in comparison with that of its eastern part. It is represented by the Caradocian Stage and/or Upper Ordovician. The transgressive character of the rhythm is express by change upward from sandstone-siltstone-carbonate varieties to clay-carbonate. The regressive part of the rhythm is represented by variegated detrital carbonates on the west, clay-sulfate-carbonate in the central part, and some salt in the northeast.

The Early Silurian-Ludlovian rhythm (0.1-1.2 km) is widespread and more marine. Transgressive (Lower Silurian) and regressive (Ludlovian) series are well expressed. On the extreme northwest are variegated detrital carbonates; limestones predominate over a large part of the platform; and reef deposits are present in the east. The regressive part is characterized by secondary dolomites, beds of sulfates, and numerous breaks in the section. Variations in stratigraphic completeness are due in large part to erosion on paleo-highs.

The Pridoli-Early Devonian rhythm (up to 2.4 km) is clearly asymmetrical. The transgressive series (Pridoli and lower Lochkovian) is less prominent and the regressive series (upper Lochkovian, Pragin, and lower Emsian) is very prominent. While preserving the facies zonality of the previous rhythm, this rhythm differs in having more sandstone-siltstone beds and in the regressive part more secondary and sedimentary dolomites, sulfates. The present distribution of this rhythm has been determined to a great extent by regional erosion between Early and Middle Devonian time, and on large paleo-highs - to middle Frasnian. In contrast to the previous rhythms, the greatest thickness of this rhythm is not in the east but rather in the region of the Pechora-Kolva aulacogen, which extends across the central part of the platform from northwest to southeast.

The Middle Devonian-Tournaisian rhythm (0.1-5.0 km) has a broader facies variety. A complete stratigraphic section from upper Emsian to the Los’vin Horizon of the Visean is present in the east; however, maximum thickness is found in the south of Pechora-Kolva aulacogen.