INTRODUCTION

The Sol-Iletsk Swell is a structural feature of the Volga-Ural Anteclise. To the south, it is bordered by the Peri-Caspian Depression and to the east by the Cisuralian Foredeep. Regional geological features include a thick cover of sedimentary deposits and a salt-bearing series in the Lower Permian Kungurian Stage. The subsalt Lower Permian deposits are mainly composed of shelf carbonates, and in the Cisuralian Foredeep and northern Peri-Caspian, they are represented by depression hydrocarbon source rock. The shelf carbonates of the Artinskian–Kungurian interval contain gas condensate reservoirs of the large Orenburg Gas Condensate Field and deposits of adjacent areas. From the time of their discovery, it has been suggested that organic buildups of the margins of the Peri-Caspian Basin and Cisuralian Foredeep are the best prospective facies for hydrocarbon reservoirs. The lagoonal facies are usually linked to the reservoirs of reduced permeability, but these proved to be productive in the Orenburg Field. Gazprom Dobycha Orenburg Ltd, exploring the Orenburg Field, drilled a number of deep boreholes in this region. The study of these boreholes allowed significant refinement of the stratigraphy and lithology of the Permian Cisuralian Series in this region. The study covered the territory of the Sol-Iletsk Swell, including the Nagumanovskaya and Vershinovskaya areas of the southeastern Sol-Iletsk Swell and the adjacent basinal zone of the Cisuralian Foredeep (Gorozhanin et al., 2013). Further paleo-geographic and paleotectonic reconstructions and the study of the structure of high-capacity reservoirs and hydrocarbon source rocks require a detailed and emended stratigraphic background. The study of the biodiversity, evolution of the foraminiferal biota, and its biostratigraphic potential is fundamental for a biostratigraphic framework. It is also necessary to reexamine facies types and recognize patterns on the facies distribution in this region. It is noteworthy that, in the 1940s–1970s, D.M. Rauser-Chernousova, I.K. Korolyuk and others conducted a similar research in the Bashkirian Cisuralia region, where they studied foraminiferal assemblages and facies analysis of the Lower Permian oil and gas bearing carbonates. At the end of the 1990s, similar comprehensive studies of biostratigraphy and lithofacies were conducted by Gorozhanina et al. (1999) in the Asselian–Sakmarian bioherm beds of the Muraptalov Field.

This paper is based on the results of a detailed study of the foraminiferal microfauna and lithology of the Asselian–Kungurian beds in three main fields. The Vershinovskaya area is located on the southeastern down-dropped block of the Sol-Iletsk Swell, in its marginal part extending southeast toward the merging point of the Cisuralian Foredeep and Peri-Caspian Depression. The Nagumanovskaya Field is located to the north of the Vershinovskaya Field, on the border-line of the Cisuralian Foredeep. The Chiliksaiskaya Field is to the west of the Nagumanovskaya Field, on the side of the Peri-Caspian Depression (Fig. 1). The lithological-stratigraphic section contains persalt and subsalt sedimentary series. The persalt deposits are represented by siliciclastic (coastal marine) and red beds of the Cisuralian (Ufimian), Biarmian, and Tatarian series of the Permian System and Mesozoic continental arenaceous-argillaceous shallow
marine carbonates and siliciclastics. The subsalt series in the south of the Sol-Iletsk Swell is represented by deposits of shallow carbonate platforms. The Lower Viséan–Serpukhovian–Bashkirian platform was developed over the entire territory under consideration. By the beginning of the Permian Period, its southeastern margin was eroded and flooded. Sections usually lack Moscovian (Middle Carboniferous) deposits, as well as Upper Carboniferous deposits. The eroded surface of the Bashkirian carbonate platform is overlain by carbonate-siliciclastic basinal deposits of the Kholodnolozhian Horizon (Asselian, Cisuralian Series, Permian). The Upper Asselian–Sakmarian–Artinskian carbonate platform was formed only on the territory of the Sol-Iletsk Swell. It was separated from the basin of the Cisuralian Foredeep by Asselian barrier reefs. In the Kungurian, the entire territory was covered by evaporites.

Previous studies (Gorozhanina et al., 2006, 2007, 2008, 2009a, 2009b, 2010; Gorozhanina, 2010; Isakova et al., 2010) provided general information on the lithostratigraphic subdivision and paleontological characterization of the Permian carbonate succession of the southeastern Sol-Iletsk Swell. New lithological and biostratigraphic research were aimed at studying the microfacies of the Artinskian–Kungurian interval to enable the lithological-stratigraphic subdivision of the carbonate section and to recognize patterns in the facies distribution. This research also contributed toward solution of problems in biostratigraphy and facies of the Cisuralian Series of the Permian System, including the substantiation of biostratigraphic boundaries of horizons and the definition of the base of the Kungurian.

The definition of this boundary is particularly difficult, because the Kungurian Stage was originally rec-