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Cretaceous paleogeography of the West Siberian sedimentary basin

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Abstract

For paleogeographic reconstruction of the West Siberian basin during the Cretaceous we used a set of paleogeographic maps, which were compiled for the main epochs of the Cretaceous period. The paleogeographic maps presented in this study suggest progradational filling of the deep basin with avalanche-type sedimentation during Volgian–Barremian regression. The paleorelief and provenance of terrigenous sediments were reconstructed.

Keywords: paleogeography; clinoforms; avalanche-type sedimentation; West Siberian sedimentary basin

Introduction

Our previous study was focused on paleogeographic reconstructions of the Jurassic (Kontorovich et al., 2013). The Jurassic and, primarily, Volgian (Bazhenovo Formation) sequences of West Siberia with their anomalously high concentrations of organic matter seem to have been the major source rocks in the West Siberian basin. Reservoirs in the overlying Cretaceous strata contain much of oil and gas resources of this unique sedimentary basin. Vertical migration played a key role in the formation of the hydrocarbon pools in this area. Cretaceous paleogeography controlled reservoir and seal distribution and quality. This paper focuses on Cretaceous paleogeography.

The end of the Jurassic is characterized by a major (global) marine transgression. By late Volgian time, much of the West Siberian basin was covered by a deep epicontinental sea with a maximum water depth of 400–800 m (Bochkarev and Fedorov, 1985; Braduchan et al., 1986; Bulynnikova et al., 1978; Gurari, 1981; Gurova and Kazarinov, 1962; Kontorovich, 1976; Kontorovich et al., 1974, 1975, 2013; Pluman, 1971; Yasovich and Poplavskaya, 1975; Zakharov and Saks, 1983; and others). However, other authors concluded that the maximum water depth of the Bazhenovo sea was as deep as 200–250 m (Mazur, 1980; Rovnina et al., 1978; Ushatinskii, 1981; Zaripov et al., 1976). Most catchment areas, which were eroded to a peneplain, appear to have acted as sources of terrigenous and chemogenic sediments to the basin (Kazarinov, 1958; Gurova and Kazarinov, 1962, and others). The small amount of terrigenous sediment input was deposited along the flanks of the basin, but biogenic deposition dominated the larger central part of the basin. At this time, the basin was characterized by sediment starvation and euxinic conditions.

Mountain building took place in the Berriasian and Valanginian, producing uplift and movement of landmasses surrounding the basin (paleo-Altai, paleo-Yenisei Ridge, Siberian platform) (Kazarinov, 1958; Kontorovich et al., 1971, 1974). These tectonic events significantly enhanced physical weathering processes. During the late Berriasian–early Valanginian, a sediment-starved deep-water environment has changed to extremely high sedimentation rates. The onset of a new regime in early Cretaceous time led to the deposition of a thick cross-bedded succession, which is visible in seismic data as a set of inclined reflectors (Figs. 1–3).

The reconstruction of a Neocomian clinoform system of West Siberia was first suggested by Naumov (1977). Subsequent conceptual models for clinoform evolution were discussed in more detail in number of studies by M.M. Binshtok, V.N. Borodkin, A.M. Brekhuntsov, G.N. Gogonenkov, F.G. Gurari, N.P. Deshchenya, S.V. Ershov, V.A. Kazanenkov, Yu.N. Karogodin, V.A. Kontorovich, A.R. Kurchikov, Yu.A. Mikhailov, O.M. Mkrtchyan, A.A. Nezhdanov, I.I. Ne-

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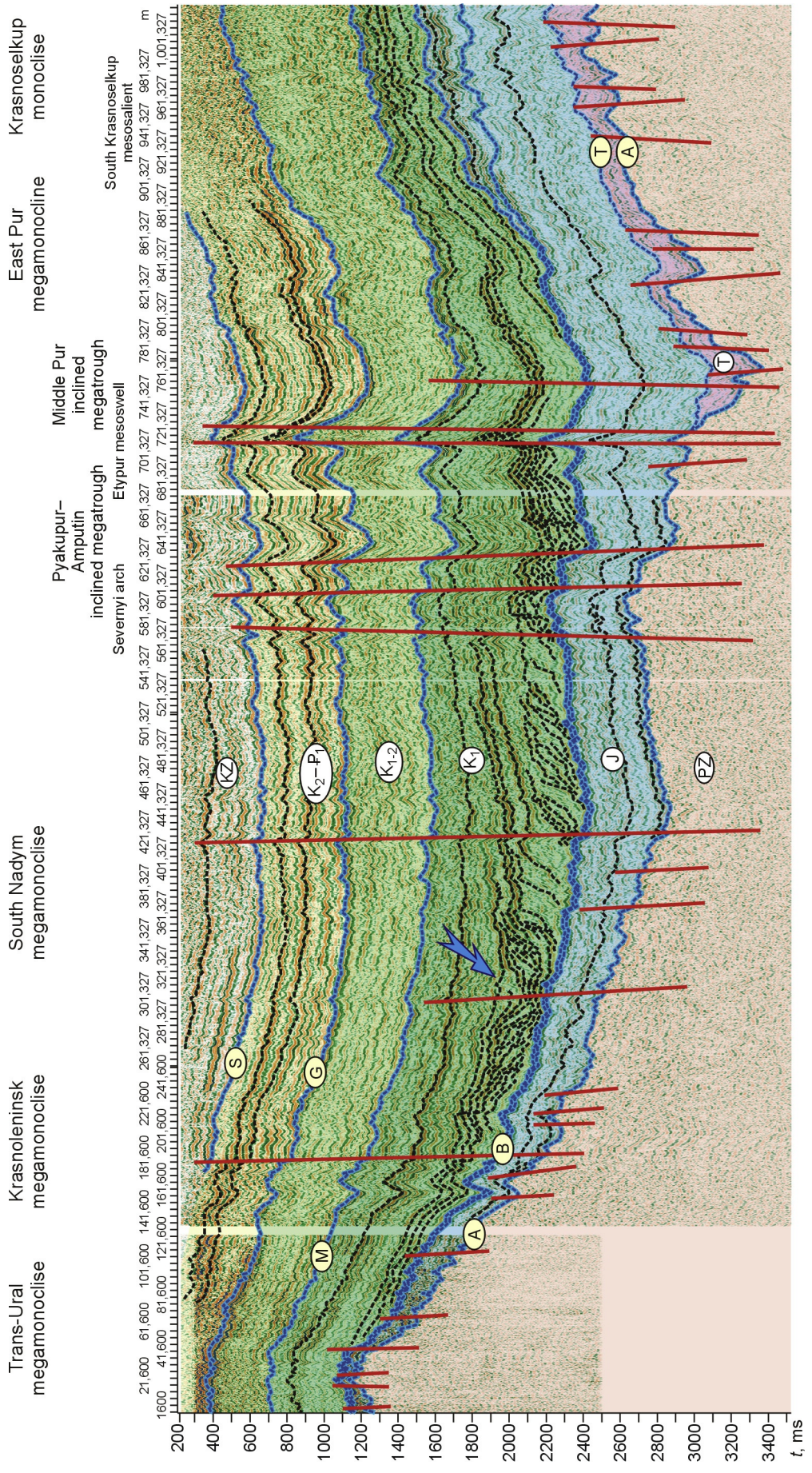

Fig. 1. Geoseimic section across Reg-19 line (West Siberian petroleum province, YaNAO).