Estimations of Some Components of Ice Conditions in Northeastern Barents Sea

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The most important hydrocarbon fields on the Barents Sea Shelf were discovered in its northeastern part, in the zone of severe climatic conditions. This paper analyzes some components of ice conditions in this zone. These components are necessary for the assessment of ice conditions at the preliminary stage of field exploitation. These are above all stages of ice development (thickness), ice concentration and boundaries of propagation, phases of ice phenomena, as well as ice cover extent—as an integral characteristic of ice conditions in this water area.

INTRODUCTION

The Barents Sea Shelf contains vast amounts of hydrocarbons. The most important fields (Shtockman, Ledovoye, Ludlovskoye, Luninskoye) have been discovered in the subsurface of the Shtockman-Lunin Mega-Saddle (SLMS), in the Russian-owned northeastern part of the sea (Fig. 1, numbers 1–4). Most specialists consider the SLMS the most prospective region of the Barents Sea, where the development of a large gas-producing center is possible, on the basis of already explored reserves and discovery of new fields (Shakhova, 2004). Some other prospective fields are also located in this region, where preliminary drilling is carried out (Fig. 1, numbers 5 and 6, Admiralteyskaya, Pakhtusovskaya, etc.). All the fields named above hold the most favorable position among other Russian Arctic shelf fields from the aspect of transportation of product. However, in spite of the evident appeal, some environmental circumstances—principal among them seasonal ice cover and icebergs, and sea depths from 200 to 300 m—make recovery of hydrocarbons in this region very complicated. Certainly, complicated ice and hydrometeorological conditions (wind, waves, icing) will be a serious constraint for development of these fields. Development of modern exploitation technologies (for example, construction of underwater production complexes) and their testing in the nearest future at the Shtockman gas-condensate field will allow us to begin organized involvement of hydrocarbon resources located in severe environmental conditions. Analyses of some elements of the ice conditions in the northeastern Barents Sea are performed in this paper. They are necessary for the assessment of ice conditions at the preliminary stage of field exploitation. First and foremost, such elements are ice cover extent (as an integral characteristic of the ice conditions in this water area), phases of ice events, stages of ice development (thickness), ice concentration and boundaries of propagation.

BACKGROUND

The Barents Sea is divided into 3 parts: the western (W), northeastern (NE) and southeastern (SE) (Vieze, 1940), of 737.3, 397.7 and 252.8 thousand km², respectively. This division takes into account general physical-geographical peculiarities of the Barents Sea (system of currents, atmospheric processes, bottom relief, etc). More recently, Mironov (1996) distinguished 7 districts within the framework of these 3 parts for a better description of local peculiarities of ice cover distribution. In accordance with his classification, the NE includes the Franz Josef Land (FJL), Kara region and Novozemelskiy—III, IV and V in Fig. 1, respectively. The above-mentioned 4 fields in the SLMS are located in the Novozemelskiy region of the Barents Sea (Fig. 1).

Traditionally, ice conditions in the NE have not been described in detail, as have those of the W and SE. There are some publications in Russian, and some information is given in reports of expeditions conducted in the late 1980s and early ‘90s in the framework of the study of the SGCF region for designing platforms (industry projects Arctic Star and IDAP). Because this information is fragmentary and oriented primarily to design purposes, however, it does not describe completely the ice conditions of this region. Mironov (2004) describes the ice conditions of the Barents Sea regions. In this paper, estimates of the components of...