Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Nadezhda Khaustova

PhD Program: Petroleum Engineering

Title of Thesis: Uranium accumulation in marine source rocks: role of redox conditions and correlation with productivity

Supervisor: Professor Mikhail Spasennykh
Co-supervisors: Professor Yuri Popov
                    Dr. Elena Kozlova

Name of the Reviewer: Sergey Stanchits

I confirm the absence of any conflict of interest	
	Date: 14-09-2022

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

The Ph.D. thesis of Nadezhda Khaustova entitled "*Uranium accumulation in marine source rocks: role of redox conditions and correlation with productivity*" addresses a detailed analysis of the factors influencing the accumulation of uranium in oil source rock. The novelty of Nadezhda's PhD study is related to the fact that usually data on uranium content are available from gamma logging data of the wells drilled in oil fields, but currently, these uranium data are used mainly to determine the lithological boundaries of unconventional reservoirs without a detailed analysis of possible uranium data correlation with reservoir productivity. I would like to note that Nadezhda was directly involved in the White Sea field trip for sampling sediments in 2018, as well as in the sediments sampling from the Laptev and East Siberian Seas. In her PhD thesis, Nadezhda studied almost a thousand core samples explored from thirteen wells of the Bazhenov Formation, and applied combined analysis of various modern techniques, such as gamma spectroscopy, thermal core logging, XRF analysis and others. Comprehensive analysis allows the candidate to clarify the main factors influencing the accumulation of uranium in marine rock. Nadezhda showed that the intervals with the maximum oil saturation index are characterized by uranium content in the range of 1-20 ppm. On the other hand, intervals with uranium content above 40 ppm and high concentration of Total Organic Carbon (TOC) in source rock are characterized by low productivity index. Therefore, I consider the topic of Nadezhda's PhD study to be important, and I think that the results obtained during PhD study can provide useful criteria for determining the most productive intervals.

The thesis is well-written, the main text is 131 pages long with additional 45 page appendix. The thesis contains five chapters, including a literature review, the analysis of uranium accumulation in marine sediments, the analysis of uranium and TOC distributions in Bazhenov Formation, and conclusion. The content of the dissertation and the implemented models are entirely consistent with the topic of the Ph.D. study, and obtained results are significant.

I have a couple of comments related to the text of the PhD thesis.

➢ I deem that, based either on the results of the performed studies or literature review, in the PhD thesis it is worth to indicate whether the native uranium mineral phases were observed in Bazhenov Formation or not. If yes – what are they related to?
➢ I have found that in the "Bibliography" section Russian letters are used many times, for example, "и др.". I recommend either including the list of all coauthors, or writing "et al." Also, the sentence "Том 1 [Электронный ресурс]" should be translated into English.

Nadezhda Khaustova has presented the results of her PhD study at six International conferences and in four papers in the Q1/Q2 ranking journals. Nadezhda is also a coauthor of a patented method for assessing deposition environment and productivity of deposits by uranium and TOC methods. Summarizing the above, I believe that the candidate is definitely qualified to receive a Ph.D. degree.

Provisional Recommendation

☒ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*