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Istituto Nazionale
di Oceanografia
e di Geofisica
Sperimentale

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Dear prof. Rafał Junosza-Szaniawski,

I reviewed the PhD thesis of MSc. Nguyen Duy Quang, following the Polish regulation, as indicate in your letter.
Here my considerations:

1. Assessment of the candidate's general theoretical knowledge in the discipline and the ability to independently carry out scientific research

The candidate has demonstrated a sound and comprehensive theoretical knowledge of the disciplines covered in this thesis. This comprehensive understanding forms the basis for the rigorous analysis and interpretation presented in the thesis.

In Chapter 1, the candidate's adeptness in the geological sciences is evident in the detailed and well-supported geological assessment, which is significantly strengthened by the integration of geophysical data. This dual approach not only confirms the geological findings but also demonstrates the candidate's ability to synthesize complex information from different scientific fields.

In Chapter 2, the dataset is well described, with all necessary information exhaustively provided for each investigation. The clarity and completeness with which the dataset is presented ensure that the subsequent analyses are built on a solid and transparent foundation. This meticulous documentation of data is crucial for reproducibility and for validating the findings of the research.

Chapter 3 illustrates the different methods used in the subsequent chapters for processing the seismic lines. The candidate meticulously considers the main steps involved, highlighting critical points and possible solutions. This shows the candidate's deep understanding of the methodology and ability to apply it thoughtfully. An important indicator of the candidate's theoretical knowledge is the careful way in which seismic processing methods are presented and applied throughout the thesis. The candidate has demonstrated a strong understanding of the theoretical principles underlying these methods and is able to apply the methodology with precision and independence. This ability is critical to advancing scientific research as it reflects the candidate's willingness to tackle complex problems and derive optimal solutions from the available datasets.

The good quality of the PSTM BalTec section and the improvement in the quality of the legacy sections, illustrated in Chapter 4, are further evidence of the candidate's ability to apply theoretical knowledge to practical scenarios. This enhancement increases the reliability and clarity of the research results, which are also presented in Chapter 5 with the seismic interpretation of the final sections and the geological sketches. These provide new insights into the geological setting of the area, showcasing the candidate's skill in integrating and interpreting diverse data sources.

Chapter 6 is well elaborated and contains the current state of knowledge of the petroleum and gas system of the area, along with new findings resulting from amplitude offset analysis (AVO) and the interpretation of shallow hydroacoustic datasets in conjunction with borehole stratigraphy. The results of this chapter represent the most interesting achievements of this work, offering significant contributions to the understanding of the area's geological and geophysical characteristics.

Personally, I would have liked to see a better defined and elaborated "Conclusion" chapter (there is a slight discrepancy between the chapter's title on page 19 in the introduction "Conclusion and Outlook" and the actual title of the chapter "Summary and Outlook") in order to have an integrated

description of the results obtained, as the last chapter is just a summary by points of the thesis. Considering that the section “6.4 Discussion”, in which the results of the individual data sets are presented, albeit separately, I do not need any further integration.

In general, the integration of results from seismic datasets, hydroacoustic data, AVO analysis, and borehole stratigraphy provides a comprehensive overview of the main geological features of the study area. The candidate’s ability to effectively combine these different data sources demonstrates not only theoretical acumen but also practical competence in geophysical and geological methods. This thorough interpretation indicates the presence of a possible gas reservoir, showcasing the candidate's ability to contribute valuable knowledge to the field.

2. The justification that the solution of the problem in the doctoral dissertation is original

The final results presented in this PhD thesis offer new and interesting insights into the geology and presence of petroleum and gas in the offshore areas of Poland, although the methods used cannot be considered innovative. However, the candidate has utilised various seismic processing tools in an appropriate and strategic manner and selected the best solutions to extract new, valuable information from the existing data. This approach emphasises the candidate’s ingenuity and technical ability and demonstrates an ability to effectively repurpose and enhance older datasets using modern analysis techniques.

The incorporation of information from Amplitude Versus Offset (AVO) analysis and shallow hydroacoustic data is further evidence of the validity of the candidate’s work. By integrating AVO analysis with seismic data, the candidate has created a robust methodological framework that significantly improves the geological understanding of the area under investigation. This methodological innovation is not just a technical improvement, but a significant contribution to the field, enabling a more nuanced and detailed characterisation of geological features.

One of the most groundbreaking results of this research is the identification of a deep gas reservoir associated with shallow gas and hydrocarbon deposits in the Polish offshore area. This discovery opens up new avenues for exploration and research as it points to a complex and rich hydrocarbon system that was not fully known before. The originality of this solution lies in the candidate’s ability to uncover previously inaccessible information, opening up a new perspective on the geological potential of the region. This advance emphasises the candidate's capacity for original thinking and his potential to drive future innovation in this area.

In conclusion, the candidate's work not only provides significant new insights into the geology and occurrence of hydrocarbons in Poland's offshore areas, but also demonstrates a high level of technical skill and methodological innovation. By using existing data with modern analytical techniques, the candidate has made a significant contribution to geological research and laid the foundation for the future exploration and development of the region. The originality and significance of these results emphasise the candidate's potential to make important contributions to the field of geology and petroleum exploration in the future.

3. Recommendation for Public Defense

On the basis of a thorough assessment of the candidate's theoretical knowledge, research skills and the originality of the dissertation, I give a positive evaluation on the admission of the candidate to the public defence of the dissertation. The candidate has demonstrated an appropriate level of competence and a deep understanding of both the theoretical and practical aspects of the topic. The dissertation is characterised by a rigorous methodology, a valid approach and innovative contributions to the field of geophysics and geological sciences.

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The candidate's independent execution of complex analyses and ability to derive significant new insights from existing data underline his readiness for public defence. In my opinion, the thesis fulfils the academic standards required for such an assessment. The clarity, depth and innovation demonstrated in the thesis reflect the candidate's willingness to engage in high level scientific discourse.

Given the solid and well-articulated results, as well as the methodical and clear presentation of the research findings, I am confident that the candidate is well prepared to effectively communicate his work during the public defence. The dissertation exemplifies a high level of academic excellence and demonstrates that the candidate has the potential to make significant contributions to his/her field. Therefore, I recommend that the candidate be given the opportunity to defend their dissertation publicly, confident that they will present his findings and methods with the same rigour and clarity that is expressed in his written work.

Moreover, the validity of the work results also from the two published works.

Kind regards,

Dr. Erika Barison