Таким образом, предлагаемый магнитно-абразивный порошок, сочетающий в себе высокие магнитные, режущие и полирующие свойства, является эффективным в технологии магнитно-абразивной обработки сложнопрофильных поверхностей. Предварительные результаты исследований таких порошковых материалов показали необходимость дальнейших исследований в данном направлении.

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GEOLOGICAL RESEARCH ON THE SEARCH FOR OIL AND GAS RESERVES ON THE SHELF OF THE EXCLUSIVE ECONOMIC ZONE OF LEBANON

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Geological studies conducted in Lebanon's exclusive economic zone indicate the likely presence of huge quantities of oil and gas offshore. Estimates are for no less than 100 trillion cubic feet of gas and 865 million barrels of oil. Lebanon has not started any exploration activities yet. On 14 December 2017, the Council of Ministers approved the awards of the first two exclusive petroleum licences for exploration and production in Blocks 4 and 9 for the consortium composed of Total SA, Eni International BV and JSC Novatek. On 9 February 2018, Lebanon signed its first offshore oil and gas exploration and production agreements for Blocks 4 and 9 with the consortium.

Lebanon is considered to become one of major producersin energy production in the Middle East. International companies are very interested and are competing over exploiting the large energy reserves detected off its coast. Every government major concerns are the output growth, unemployment and inflation and deflation rates. The goals of any government policy makers are to increase output growth, lower unemployment and lower inflation. With oil and gas exploration it is expected to create job opportunities and lower unemployment rate. Chief executive officer of the British Spectrum Geo Inc. David Rowlands said that: "the value of the gas and crude oil reserves in Lebanon is worth $140 billion". In addition, Spectrum Geo had unveiled in 2012 that Lebanon's oil and gas reserves off its coast are of the richest and best in the Mediterranean.

Purpose of the work – to summarize the results of geological research on the search for oil and gas reserves on the shelf of the exclusive economic zone of Lebanon.

Methodology. Crustal modeling based on the latest studies of the Eastern Mediterranean geodynamics, as well as modern geophysical data, will allow the interpretation of crustal profiles across the entire STP platform (saida tire platform). This was done through numerical modeling taking into account the free-air gravity anomalies (Zeyen and

Fernàndez, 1994; Zeyen et al., 2005) shows the location of the modelled section on the topography and the free-air gravity maps (Fig.1).

Free-air gravity anomalies (1-minute grid spacing) are extracted from publicly available worldwide database TOPEX (www.topex.ucsd.edu). A 50 km wide strip was extracted on both sides of the profile and the values were averaged every 5 km. The variability of data within the strip was considered as data uncertainty. The modeled lithosphere is divided into bodies representing from top to bottom: different layers of sediments, a continental upper crust, a continental lower crust and a lithospheric mantle. The oceanic crust is considered to have similar properties as the lower continental crust. These bodies are characterized by the following rock properties: 1) density and its dependence on temperature and depth; 2) thermal conductivity; 3) heat production. The shape, size and characteristics of the bodies are modified interactively in order to find the best-fitting model with the geophysical data used as input. The numerical model combines joint interpretation of thermal and mass distribution related data. The temperature distribution is calculated using a finite element algorithm in two dimensions using the ponderation method within the bodies forming the model.

Results. Crustal modeling. Free-air gravity anomalies extracted along the profile increase progressively from −60 mGals in the N-W to reach +60 mGals in the S-E which is in good agreement with the calculated anomalies (less than 8 mGals of uncertainty. The geophysical model invokes a 20–21 km thick crust under the STP in the closest part to the coast that thins progressively to reach a thickness of 5–6 km in the N-W, in the central part of the basin (Fig. 2).

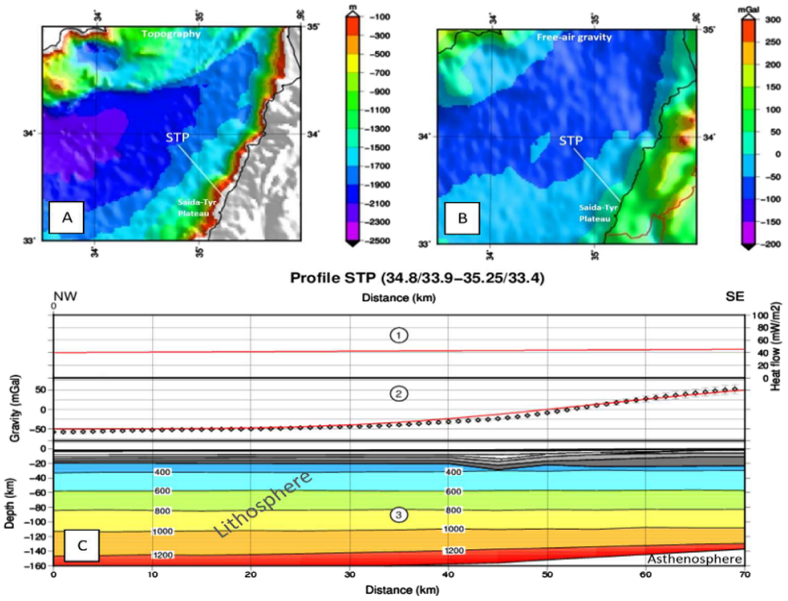

Fig. 1 – (A), (B) Location of the modeled cross section STP on the topography and free-air gravity maps, respectively (Topex database); (C) Modeling results for profile STP. Graph C1 shows the calculated heat flow for the model. Graph C2 represents the observed gravity anomaly (diamonds: dots with error bars) and the data calculated for the model shown without vertical exaggeration (solid line). The error bars correspond to the data uncertainty for the standard deviation within a range of 5 km to each side of the profile. In graph C3, the crust is represented in grey shades and the lithospheric mantle contains the temperature distribution with isotherms every 200 °C and finally the asthenosphere in white, separated by the Lithosphere-Asthenosphere Boundary (LAB) from the lithosphere

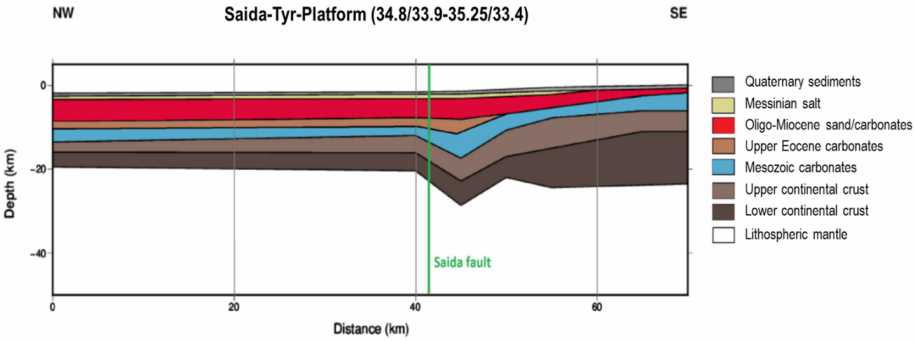

Fig. 2. Crustal model of profile STP based on gravity data

The interpreted Moho is about 19 km deep in the N-W and deepens to 28 km close to the coastline. Such Moho depth configuration appears logical with respect to data provided from previous work (~ 22 km in the center *versus* ~ 26 km at the margin of the basin, see above, Sect. 2.1). This crust is of continental nature and is believed to be constituted of a lower part with a density of 2900 kg m^{-3} density and an upper crust with a density of 2750 kg m^{-3}. The intersection of the Saida fault with the modeled profile could be well recognized at the distance of 45 km from the N-W. The Saida fault represents a fracture in the crust and at the same time a smooth transition between a thick crustal part connected to the continent and a thinner crust basinwards.

The density of the Plio-Quaternary sediments varies between 2200 kg m^{-3} and 2600 kg m^{-3}. These are underlain by a 2 km thick unit of salt with a density of 2100 kg m^{-3}, a layer of 2450 kg m^{-3} consisting of dense Cenozoic siliciclastics, and finally a thick layer of Mesozoic sediments of a constant density of 2550 kg m^{-3} overlying the crystalline crust. This last layer is considered to be compacted enough not to have a density dependent on pressure.

Conclusion. This contribution focuses the Saida-Tyr Platform (STP), an offshore area adjacent to the southern Lebanese coastline – part of the eastern margin of the Levant Basin, which is actually one of the licensed acreage for hydrocarbon exploration. A relatively extensive synthesis of previously (recently) published research work tackling crustal modeling, structural geology, stratigraphy and geochemistry helped in better integrating geo-data and shaping up the geological understanding of this area. In addition, a new crustal model and the interpretation of seismic reflection specifically on the STP led to the following conclusions:

- The Levant margin along the northwestern border of the Arabian Plate and the intra-plate Palmyra Basin (Syria, hinterland), witnessed similar tectonic events with rifting and inversion, followed by strike-slip tectonics in the Late Miocene.
- The STP is bordered by characteristic structural features and constitutes an extension of the Arabian continent into the Levant Basin, with similar crustal rheological properties.
- In addition to the typical Levant Basin tectonostratigraphic elements with thick Cenozoic series, the STP is also characterized by relatively thick Mesozoic successions – similar to the surface exposed strata onshore Lebanon, highlighting the margin petroleum systems.
- In the STP, the Upper Jurassic/Lower Cretaceous clastics and carbonates are believed to provide potential reservoir plays that could have been charged by the deeper Mesozoic source rocks, and sealed by Cretaceous marly layers. The edge of the Cretaceous

carbonate platforms (slope debris) and potential carbonate buildups are interesting to further investigate. While the western and northern anticlinal structures bordering the STP are excellent targets for Oligo-Miocene biogenic gas charging systems.

The STP is an excellent example of the eastern margin of the Levant Basin offshore Lebanon, with a broad diversity of potential plays for hydrocarbon exploration; by integrating geodynamics, tectono-stratigraphic interpretations and petroleum systems analyses, such plays are better constrained and exploration risk lowered.

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ГЕОФИЗИЧЕСКИЕ ИССЛЕДОВАНИЯ СКВАЖИН В ПРОЦЕССЕ БУРЕНИЯ

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Геофизические исследования скважин (ГИС) в процессе бурения это наиболее перспективная технология, включающая в себя одновременно бурение и исследование скважины геофизическими методами. В первую очереди она очень экономична с точки зрения времени, средств, оборудования и прочих затрат. Данную технологию использовали в Беларуси в 2020 г. на месторождениях в ведомстве РУП ПО «Белоруснефть.

На сегодняшний день все передовые компании активно используют технологии каротажа в процессе бурения как для разведки новых, так и для оптимальной разработки уже эксплуатируемых месторождений.

Каротаж в процессе бурения позволяет:

– контролировать пространственное положение скважины относительно геологических объектов;

– определять качественные и количественные характеристики пласта с целью бурения по наиболее эффективной части коллектора (пласта);

– получить наиболее объективные данные для оценки свойств пласта за счет минимизации времени от вскрытия пласта до ГИС вследствие того, что фильтрат не успевает насытить прискважинную зону;

– отказаться от проведения окончательного каротажа на кабеле или на буровом инструменте, что существенно снижает затраты недропользователей за счет уменьшения срока строительства скважины.