Reviewer report

Title Research on cosmic matter on Earth and in nearby space; research on the biological and geochemical specifics of the early Earth

The proposal submitted by the Astrobiology Sector of the Laboratory of Radiation Biology (JINR) focuses on preparation and irradiation of meteorite matter and organic samples with hadron beams; clean room for prebiotic chemistry research, handling collection of meteorites and cosmic matter samples; study of microfossils with electron scanning microscopy; data analysis, systematization and interpretation. The topics are introduced in detail and full described.

PART A: Achievements

– **scientific merits and intellectual contribution (Achievements)**;

the project is a continuation of a previous program. The objectives of the proposal are well defined, they encompass the main topics of Astrobiology, including the formation of the first prebiotic compounds, the role of meteorites as catalysts, the mineralogical origin and elemental (isotopical) composition of meteorites and cosmic dusts. The project has already led to different significant results described International conferences and Proceedings, and publication in English language:

2. Publications:

1) Bizzarri B.M., Šponer J.E., Šponer J., Cassone G., Kapralov M.K., Timoshenko G.N., Krasavin E.A., Fanelli G., Timperio A.M., Di Mauro E., Saladino R., Meteorite assisted phosphorylation of adenosine under proton irradiation conditions // Chem.Systems.Chem. 2020, V.2, No.3, P. e1900039. doi: 10.1002/syst.201900039

Performing the experiment, irradiation, data acquisition and interpretation.

2) Bizzarri B.M., Manini P., Lino V., Ischia M., Kapralov M.I., Krasavin E.A., Mrazikova K., Sponer J., Sponer E., Di Mauro E., Saladino S., High-Energy Proton Beam-Induced Polymerization/Oxygenation of Hydroxynaphthalenes on Meteorites and Nitrogen Transfer from Urea: Modeling Insoluble Organic Matter? // Chem. Eur. J., 2020. V.26, P.14919 – 14928. doi: 10.1002/chem.202002318

Performing the experiment, irradiation, data acquisition and interpretation.

3) Rozanov A.Yu., Hoover R., Ryumin A.K., Saprykin E.A., Kapralov M.I., Afanasyeva A.N. New finds of microfossils in the Orgueil meteorite. // Paleontologicheskiy zhurnal (Paleontological Journal), 2021, No. 1, pp. 1–3 doi: 10.31857/S0031031X21010116 (in Russian).

Key equipment, data analysis, systematization and interpretation.

4) Rozanov A.Yu., Hoover R.B., Krasavin E.A., Samylina O.S., Ryumin A.K., Kapralov M.I., Saprykin E.A., Afanasyeva A.N. An atlas of microfossils in the Orgueil meteorite. // Rozanov A.Yu., ed. in chief. Moscow: Paleontological Institute, Russian Academy of Sciences, 2020. 130 pp., 5 figs., 40 photo tables. In Russian and English. ISBN 978-5-903825-42-4.

Talks:

Hoover R.B., Rozanov A.Yu. Evidence for indigenous microfossils in carbonaceous chondrites // The Tenth Moscow Solar System Symposium. (Space Research Institute. October 7-11, 2019).

Ryumin A.K., Kapralov M.I. Astrobiological studies in Dubna // The Tenth Moscow Solar System Symposium. (Space Research Institute. October 7-11, 2019).

PART B: Plans and requests

– **technical feasibility of the project within the proposed timescale**;

The technical feasibility for the project is accurately, including specific JINR facilities. A specific oriented database has been developed. Overall, the technical feasibility of the project appears to be adequate for achieving all the proposed objectives within the indicated timescale. External collaborations further implemented the feasibility of the proposal.

– **compliance of the requested financial resources with the project objectives**;

. The requested financial source (130,000 USD for three years) is completely adequate for the suggested work plan, it includes the construction and equipment of a block of clean and cold rooms.

– **availability of adequate human resources at JINR and in the collaborating institutions**."

The human resources at JINR and in the collaborating institutions are full adequate for the feasibility of the project.

Definitive comment:

Category A: excellent projects, which should be fully funded with adequate resources and encouraged to continue and expand their impact.