

# SATELLITE EXPLORATION OF EARTH RESOURCES USING NUCLEAR MAGNETIC RESONANCE PHENOMENON

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## INTRODUCTION

Now, humanity stands in front of serious challenges due to political, economic, energy and climate problems. To solve the described challenges, innovative, more effective, economically feasible, faster, and environmentally friendly technologies are needed to explore underground to produce metals, rare elements, critical raw materials, water and geothermal energy. Among new exploration targets are geological resources for underground storage of energy (hydrogen storage or compressed air energy storage (CAES), CO<sub>2</sub> storage, or radioactive waste storage).

The innovative technology of Satellite Exploration of Earth Resources Using the Nuclear Magnetic Resonance (NMR) Phenomenon - "SKYGEOEXPLORENOVA-NMR" - (SGEN-NMR) is proposed. The main idea of the innovative method lies in the point-by-point sounding of an area with frequency spectra that excite resonance in the target substance. Sounding radio-frequency radiation should be highly directional to concentrate the transmitter's power in the right direction. Point-by-point resonance location sounding allows searching for deposits, obtaining their underground contours, and geological sections and selecting optimal drilling points. Based on these data geological resources of the deposit could be estimated. The magnetic field of the Earth is used as the source of a constant magnetic field to create NMR conditions in the molecules of a target substance at depths of up to 5 km (Ivashchenko, P. et al., 2016, Ivashchenko, P.N. & Geenko, V.P., 2020, Patent 2011, 2013).

For the first time, an updated routine for the exploration process is presented here (Fig. 1).

## PROCESS FLOW OF SGEN-NMR

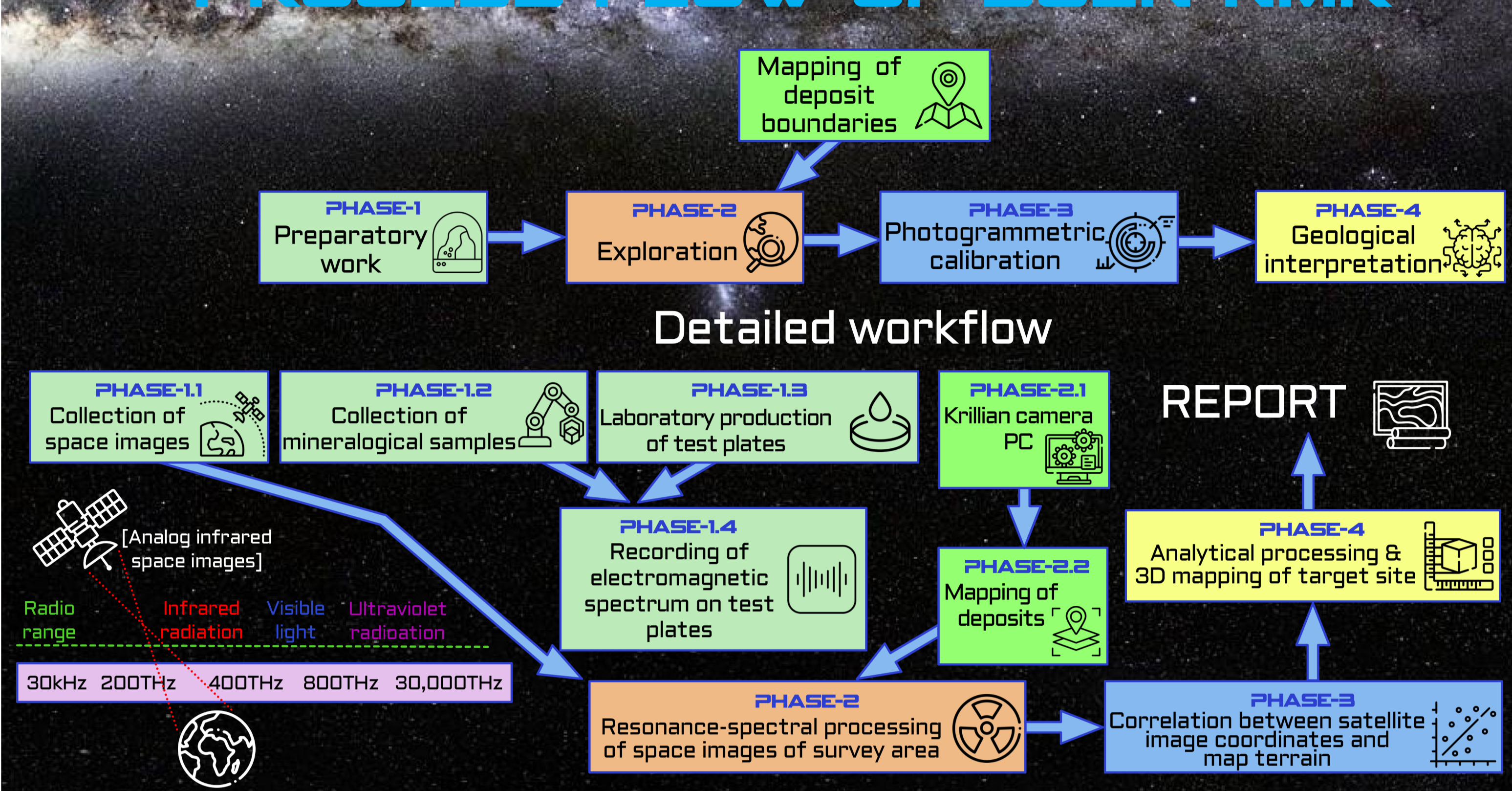
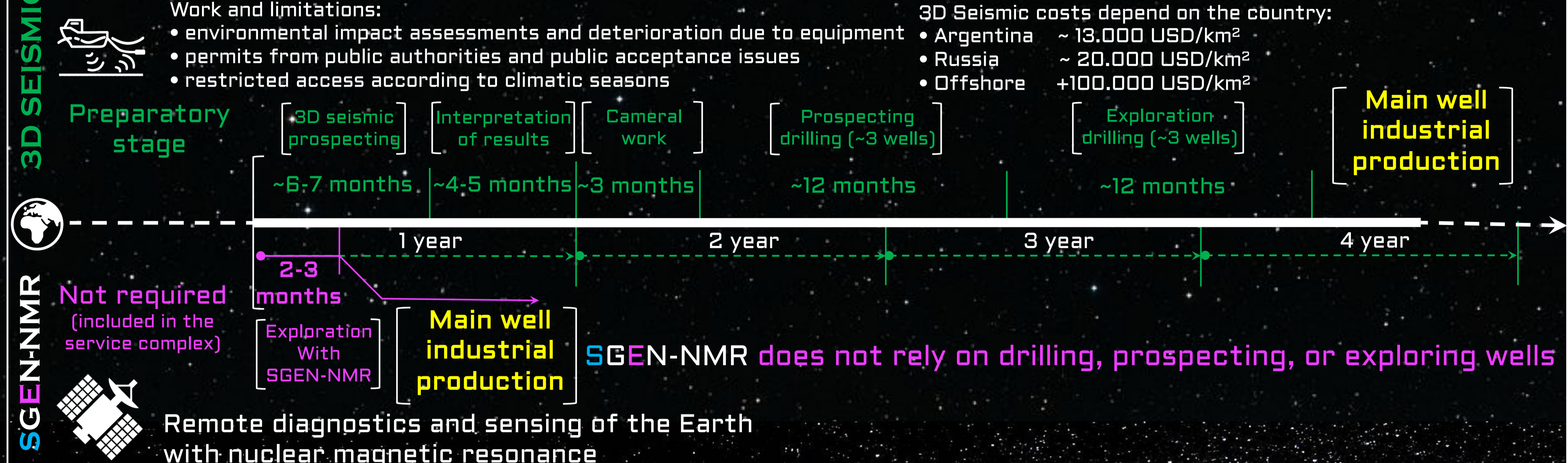


Fig. 1. Four main phases and detailed workflow of SGEN-NMR technology and frequency range used for analogue space images.

## COMPARISON WITH TRADITIONAL METHODS (TIMELINE)



## IMPLEMENTATIONS

- HYDROCARBONS** [oil, gas, condensate, oil shale]
- ELECTRIC INDUSTRY ORES** [Lithium, Nickel, Rare Earth Elements, Critical Raw Materials, etc.]
- PRECIOUS & METALS** [Diamonds, Gold, Silver, Copper, Iron, Aluminium...]
- GEOTHERMAL ENERGY & WATER**
- UNDERGROUND STORAGE OF GASES** [CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>]
- RADIOACTIVE WASTE STORAGE site** [water in crystalline rocks]

**Remote scanning [Great area]**  
 We can survey per month up to 50,000 km<sup>2</sup>  
 We can reach onshore/offshore depths up to 5,000 m [Great depth]

**SGEN-NMR**

**Opportunities**

The main benefits of SKYGEOEXPLORENOVA compared to traditional geophysical methods:

- Lower price
- Accuracy (> 90%)
- Environmentally friendly
- Time of exploration (2 months)
- Avoidance of permits from public authorities and public acceptance issues

**PATENTS & TESTIMONIALS**

**SKYGEOEXPLORENOVA-NMR**

**REFERENCES**

- Ivashchenko, P., Bakai, E., Yurchuket, A., 2016. About the possibility of identification of hydrocarbon deposits with the help of NMR» European scientific journal «Geoscientific Instrumentation Methods. Copernicus, <https://gi.copernicus.org/articles/5/551/2016/gi-5-551-2016-discussion.html>
- Ivashchenko, P.N., Geenko, V.P., 2020. Experience with the application of «Geodirect» technology for deep freshwater prospecting. VII International scientific-practical conference "Topical issues of science and practice" November 2-06, 2020, London, Great Britain.
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