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## The results of testing methods of frequency resonance processing of satellite images within areas of technical micro-diamonds (lonsdalite) deposits location

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### SUMMARY

The results of reconnaissance studies in the areas of Ilyinetsky and Popigaysky craters (ring structures) location, as well as the Kumdy-Kol micro-diamond deposits in Northern Kazakhstan are analyzed. Additional facts have been obtained in favor of the volcanic nature of all investigated structures. These evidences are the roots of deep channels (volcanoes), filled with ultramafic rocks at great depths: 723 and 470 km. Within all three objects of the survey, no responses from kimberlites and traditional diamonds were recorded; signals at the resonant frequencies of technical micro-diamonds (lonsdalite) were recorded. By the cross-section scanning the following intervals of the responses from lonsdalite fixing are identified: Ilyinetsky structure – 300 m - 23-24 km; Popigai Crater – 290-16730 m; Kumdy-Kol deposit – 70-2420 m. The conducted studies also suggest the possible synthesis of the lonsdalite mineral in volcanic complexes, filled with ultramafic rocks. It is advisable to conduct a survey of volcanoes of this type in order to record responses at the resonant frequencies of this mineral. Lonsdalite detection sites in various regions are also worth exploring. In general, mobile direct-prospecting technology of frequency-resonance processing of satellite images and photographs can be used to study the deep structure of ring structures in different regions of the globe and their genesis establish.

**Introduction.** The results of experimental studies obtained in the Ukrainian marine Antarctic Expedition of 2018 (Yakymchuk et al., 2019a) forced the authors to pay attention to volcanic activity. Recently, when conducting experimental research of a search character, a certain set of additional measurements is almost universally performed to detect predicted (and existing) volcanic structures within the survey sites and areas. Work is also being carried out purposefully to examine (study) the deep structure of volcanoes of various types. Some results of already completed work of this nature have been published (Yakymchuk and Korchagin, 2019b).

And another area of research with mobile direct-prospecting methods using seems quite interesting. In many cases, specialists do not have enough data to unequivocally solve the question - is the concrete (studied) ring structure a volcanic structure, or a meteorite crater? The results of the mobile direct-prospecting methods application in areas of the ring structures location can bring some clarity for this issue solution. This circumstance determines (sets) another direction of research - the examination of sites (areas) of the ring structures location in order to establish their (possible) genesis - the structure is a meteorite crater or volcanos. This report presents the results of reconnaissance studies in the areas where the Ilyinetsky and Popigaysky craters (ring structures) are located, as well as the Kumdy-Kol micro-diamond deposits in Northern Kazakhstan.

**Research Methods.** Experimental studies were carried out using the technology of integrated assessment of the oil and gas prospects of large search blocks and local areas, which includes methods of frequency resonance processing of satellite images and photographs, as well as vertical sounding (scanning) of a cross-section in order to determine the depths and thicknesses of productive horizons and cross-section rocks. The features of the technology used, as well as the results of its testing and practical application, are described in articles and conference materials, including (Yakymchuk et al., 2019a; 2019b; Yakymchuk and Korchagin, 2019a-b).

**The main tasks of experimental reconnaissance work.** 1. Obtaining additional information to resolve the issue of whether the structures examined are meteorite craters or volcanic complexes.  
2. Obtaining new data on the prospects of diamond content of the examined craters.

Some information about the Ilyinetsky crater is given on the websites (Ilyinetsky ...; Satellite ...), and Popigaysky – (Diamonds ...; RAS ...; Tomtor ...; Scientists ...). The articles (Tretyakova and Lyukhin, 2016; Lyukhin, 2017) present research materials at the Kumdy-Kol deposit and discuss the problem of the origin of diamonds.

We also note the following. In 2019, a document with photos of micro- diamonds from the Popigai crater was discovered on one of the sites. However, the resonant frequencies of these diamonds differed from the frequencies of traditional diamonds. When processing a satellite image of the Popigai structure, signals at the resonant frequencies of traditional diamonds were not obtained.

In this regard, for the experiments, photographs were prepared of two samples of lonsdalite (Figures 1-2), borrowed from sites (Lonsdalite ...; Mineral ...). These minerals (“impact” diamonds) were found within the survey structures, and in significant quantities in the Popigai crater (Diamonds ...).

Further experiments with samples of lonsdalite in Figures 1 and 2 showed that their resonant frequencies do not coincide. The responses from the sample in Figure 1 were also not recorded when processing satellite images in Figures 3-4, and from the sample in Fig. 2 - signals were confidently recorded. In this regard, in further experiments, we used a sample of lonsdalite in Figure 2. It can also be assumed that the sample in Figure 1 is an artificial mineral.



**Figure 1** Lonsdalite ?!  
(Lonsdalite...).



**Figure 2** Lonsdalite  
(Mineral...).

**Ilyinetsky crater.** During the frequency-resonance processing of a satellite image of the Ilyinets structure (Figure 3), no responses from hydrocarbons (oil, condensate, gas), amber, oil shale, argillite breccia, gas hydrates, hydrogen, water, diamonds, traditional salt and potassium magnesium salt were not recorded from the surface; signals from dead water have been received.

No response from sedimentary rocks. Only signals from the 7th group of igneous rocks (ultramafic rocks) were received. By fixing responses at various depths (5, 50, 150, 250, 350, 450, 550, 650, 750, 722, 723 km), the root of a channel (volcano) filled with ultramafic rocks was determined at a depth of 723 km.

We note once again that no responses from diamonds and kimberlites were received from the surface during image processing of the structure, and signals from lonsdalite were recorded!

By scanning the cross-section from 50 cm with step of 50 cm, responses from lonsdalite were obtained in the interval: 1) 300 - (400-good) - 610 m. Responses from this mineral were also recorded from the lower part of the cross-section on the surfaces of 1 km, 5, 10, 20, 23 km; no signals from lonsdalite were received at depths of 24, 25, 30, 50, 80, 90 and 100 km.

When scanning a cross-section from the surface, a step of 50 cm, signals from ultramafic rocks began to be recorded from 80 m.

Responses were also received from the surface at frequencies of the following chemical elements: zinc, gallium, thallium, lead, bismuth (good signal) and polonium.



**Figure 3** Satellite image of the area of the Ilyinetsky crater (Satellite...).



**Figure 4** Satellite image of the area of the Popigai Crater.

**Popigai Crater.** During the image of the Popigai structure (Figure 2) processing, no responses from kimberlites and diamonds were received from the surface, signals (strong) from lonsdalite were detected immediately.

Responses from the 7th group of sedimentary rocks (limestones), as well as 7th, 8th, and 9th igneous groups, were recorded from the surface.

Signals from the 7th group of sedimentary rocks were recorded from the lower part of the cross-section on the surfaces of 500 m, 700, 800 and 900 m; on the surface of 1000 m, responses were already absent.

From the 7th group of igneous rocks on the surface of 900 m, there were no responses from the upper part of the cross-section. By fixing responses at various depths (5, 50, 150, 450, 550, 500, 400, 470 km), the root of a channel (volcano) filled with ultramafic rocks was determined at a depth of 470 km.

From lonsdalite, responses from the lower part of the cross-section were obtained at the surface, as well as at depths of 1 km, 9, 15, and 16 km; no signals were received at surfaces of 17, 18, 20, and 25 km.

The signals from lonsdalite were recorded when scanning the cross-section from 16 km, a step of 10 cm and 1 m to 16730 m.

Responses from this mineral were obtained on a surface of 16800 m from the upper part of the cross-section. No responses were received from the bottom.

By scanning a cross-section from the surface, a step of 1 m, responses from lonsdalite were obtained from the following intervals of the cross-section: 1) 290 - (medium) - 690 m; 2) 1100-1250 m; 3) 1370-1830 m; 4) 2030-2185 m, (up to 2.5 km traced).

When scanning a cross-section from the surface, a step of 1 m, responses from the 7th group of igneous rocks began to be recorded from 440 m and were tracked (by scanning) only to 1000 m.

Responses were also obtained from the surface at frequencies of the following chemical elements: zinc, gallium, thallium, lead, bismuth and polonium.

**Kumdy-Kol deposit, Northern Kazakhstan.** A satellite image of the field's location (Figure 5) was provided by one of the authors of article (Tretyakova and Lyukhin, 2016); another photo was mistakenly published in this article.

At the initial stage, a fragment of the image in Figure 5, including the lake and the area near it, marked with a marker, was processed. No response was received from the surface in this area from oil, condensate, gas, amber, hydrogen, water, diamonds, or salt. Signals from dead water and potassium magnesium salt were recorded. No response from sedimentary rocks.

Signals from the 7th group of igneous rocks (ultramafic rocks) were recorded.

By fixing responses at various depths (50, 150, 250, 350, 450, 550, 470 km), the root of a channel (volcano) filled with ultramafic rocks was determined at a depth of 470 km.

When scanning a cross-section from the surface, a step of 50 cm, signals from ultramafic rocks began to be recorded from 100 m, after some break, from 1700 m.

The signal from lonsdalite is fixed from the surface.



**Figure 5** Satellite image of the area of the Kumdy-Kol deposit, Northern Kazakhstan.

By scanning the cross-section from the surface, a step of 1 m, the signals from lonsdalite were recorded in the range of 1380-2500 m.

When processing the entire image in Figure 5 signals from lonsdalite were recorded by scanning with a step of 1 m in the interval of 70-2420 m.

When processing the image of the deposit (Figure 5), additional experiments with the samples in Figures 1-2 have been conducted.

Signals of carbon and cesium were obtained from lonsdalite on Figure 2.

Signals of carbon and silver were obtained from the second lonsdalite sample (Figure 1), cesium signals were absent there.

When processing a satellite image of area in Figure 5 signals from the lonsdalite sample in Figure 1 were not received.

Signals from cesium and carbon were recorded from the surface during processing of this image (Figure 5), but no responses from silver were obtained. Signals from carbon were recorded on surfaces of 58 and 59 km, and responses were already absent at 60 km.

Responses from cesium on the surface of 58 km were obtained, for 60 km – not received.

There were no responses from silver on the surface of 58 km.

**Brief comments and conclusions.** The conducted experimental studies of reconnaissance character allow to conclude following.

1. Additional facts have been obtained in favor of the volcanic nature of the Ilyinetsky and Popigaysky craters. These facts are the roots of volcanoes filled with ultramafic rocks at great depths: 723 and 470 km.

2. Within all three examined structures, no responses from kimberlites and traditional diamonds were recorded. Signals from lonsdalite were recorded within all investigated structures.



3. At the Ilyinetsky and Popigaysky structures, responses from the lonsdalite mineral are fairly confidently recorded. It should be noted that the intensity of the signals at the resonant frequencies of lonsdaleite in the contours of the Popigai structure was higher than at Ilyinetsky.
  4. On the other hand, the interval of recording responses from lonsdalite on the Ilyinets structure (300 m - 23-24 km) is longer than on the Popigaysky (290-16730 m). At the Kumdy-Kol deposit, signals from lonsdalite were recorded from the interval of 70-2420 m.
  5. The root of the Ilyinetsky volcano is also located at a greater depth (723 km) than Popigaysky (470 km). It is possible, however, that a younger volcano with a root at a depth of 470 km is also located within the Ilyinetsky structure. However, the solution of the question of the existence of such a volcano requires additional experiments – the establishment of which specimens from the 7th group of igneous (ultramafic) rocks are fixed in the depth intervals of 0-470 km and 471-723 km. Experiments of this nature have been repeatedly carried out within channels (volcanoes) filled with granites.
  6. The studies also suggest a possible synthesis of the lonsdalite mineral in volcanic complexes filled with ultramafic rocks. It is advisable to conduct a survey of volcanoes of this type in order to record responses at the resonant frequencies of this mineral. Lonsdalite detection sites in various regions are also worth exploring.
- In general, the results of reconnaissance studies carried out allow us to conclude that mobile direct-prospecting technology of satellite images and photographs frequency-resonance processing can be used to study the deep structure and determine (establish) the genesis of ring structures in different regions of the globe.

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