

The Popigai crater in the capacity of interplanetary structural analog.

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Abstract

In central Arctic Siberia of Russia is situated one of interesting placing our planet crater Popigai. It is the 4th largest impact crater on Earth but the best exposed, the three other craters are larger, but they are either buried (Chicxulub), strongly deformed (Sudbury), or deformed and severely eroded (Vredefort). The crater is filled with melted and shattered material, including microdiamonds and other high pressure minerals characteristic of ultra-high pressure formed during the catastrophic impact.

1. Introduction

One of very interesting astroblem of Earth is one hundred kilometres Popigai structure, centred at 71°34'N, 111°12'E in central Arctic Siberia (Fig. 1, 2), that has been ascribed as nature conservation object of our planet of significant first value [1], [2].

2. Popigai astroblem

The scientific discovery and investigations the Popigai crater we obliged to Russian scientists Vishnevsky S.A., Masaitis V.L., Fel'dman V.I. and many others which many long years studied this problems.



Figure1: Popigai astroblem (Russia, Krasnoyarsk Territory – Sakha-Yakutia, diameter about 100 km, formation time 34.7 ± 0.2 million years ago).

Popigai crater was formed into two-layer target of Archaean crystalline rocks of the Anabar Shields, and overlying Proterozoic to Mesozoic sedimentary sequences. Basement rocks are represented by the Verkhne-Anabar (lower layer up to 10 km thick) and the Khapchan (about 800-1200 m) series [3].

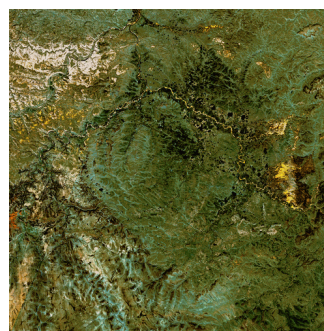


Figure 2: Space image of Popigai meteorite crater. Clearly showed the inner part about 80 km with a darker tone of forest. In Western and North-Western sectors of crater clearly showed exits fragments of bottom old crater and melt rocks (tagamites).

It might be supposed that space body with high velocity break through thickness sediment ~1200 m and decelerate in basement complex Siberian platform of Anabar shield. The estimate power of explosion is 10^{23} J that in 1000 time more than strong volcanic blast. The large-size cank blocks flies away on distance till 40 km beyond crater border. The impactor has been identified as either an eight-kilometer diameter chondrite asteroid, or a five-kilometer diameter stony asteroid.

3. Moon astroblem

A natural extension of interest in Earth craters outer origin became the Moon. After studying Lunar soil brought S/C series "Luna" and "Apollo" identified traces impact metamorphism in these samples, and the problem of impact origin of Lunar craters was solved.

A detailed study of these craters revealed visual morphological criteria differences between impact and volcanic structures, which soon led to the discovery of many astroblems in solid bodies of the Solar system. It became clear that impact events are one of the fundamental natural processes during the formation of the substance in the universe. Of course, these processes have played an important role in the evolution of the Earth and its modern form.

4. Conclusions

Age of Popigai crater estimated 34.7 million years is close with the globally disaster on the border sediment of Eocene and Oligocene epochs. In this layer found Ir anomaly, microtektite, coesite and other signs of impact event. Numerical simulations of Popigai impact events showed [4], that it can produce global dispersal of the impact substance (maximum speed of evaporated substances were reaching 15 km/c).

In Soviet times the area of Popigai crater was closed. In 2011 year is scheduled expedition to Popigai crater. It is going to carry out scientific goals concerned with confirmation of hypothesis of impact origin of Popigai crater: included looking-for traces of impact metamorphism and magnetic and isotope anomaly; the validation of satellite data of all area (including different decoding of characteristic observable on orbit). During expedition it is possible to perform field operation and sampling in different places inside Popigai crater. Part of investigations may carry out *in situ* in Popigai crater using microscope and spectrometric instruments. In particular we would take laboratory analyses of regolith for impact-metamorphic rocks for landers of future space mission.

In addition to results of investigation we suppose to use for laboratory simulation of impact processes on the base of laboratory of impact methods in IKI [5].

References

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